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CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIALS—
- The London Treatise on the Manufacture of Coal Gas.141
- Street Lighting.....141
- Provincial Gas Coals.....142
- Gas Valves for Street Mains.....142
- The Price of Gas for Public Lamps in the New York City Parks.....142

New City Gas Company of Montreal.....142
Provincial Gas Coals.....143
On the Volumetric Determination of Sulphur and Ammonia in Illuminating Gas, with a Description of the Apparatus Employed.....144
Barbadoes Gas Co.....145
Influence of Pressure on Combustion.....145
Report of the Proceedings of the New England Association of Gas Engineers.....145
The Manufacture of Coal Illuminating Gas.....147
Weights and Measures.....148
Periodicity of Severe Winters.....149
CORRESPONDENCE—
- Temperature of Retorts.....150
- Cotton Seed for Gas Making.....150
- Arrangement for Cleaning Test Tubes, etc.....150

Gas-Light Intelligence.....150
On the Existence of Solid Particles of Carbon in Luminous Flames.....150

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS*, or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

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THE LONDON TREATISE ON THE MANUFACTURE OF COAL GAS.

This work is now being issued in monthly numbers, and will be one of the most valuable compendiums of information bearing upon the history and the science and practice of gas manufacture yet published. Every gas manager should have it. It is issued in paper covers, so that it can be bound to suit the taste of the subscriber. The issue will occupy about two years. The price of each number, if furnished from this office, is 40 cents a number, or $4.80 a year.

We have already received many subscriptions, and we would urge all those who have not yet sent us their names to do so at once. We propose to send bills for the first 12 numbers upon receipt of subscription.

STREET LIGHTING.

The recent prices for lighting the street lamps in New York City seem to have excited considerable discussion in various parts of the country. We are in receipt of letters from all parts of the Continent upon this subject, and we give the following for the information of our readers. There are in the city of New York five gas companies that have, for some years past, been supplying gas to the street lamps. This does not include the 23d and 24th wards, north of Harlem river, which were recently annexed, and where old contracts, made for a term of years with companie situated therein, are still in force. Of the five companies above referred to, the New York Gas-Light Company's district includes that portion of the city below Grand street; the Manhattan district extends from Grand street to 34th street, and from North to East River; the Metropolitan district extends from 34th to 79th streets, and from river to river; the Harlem district from 79th st. to Harlem River and Spuyten Duyvel Creek. The works of the New York Mutual Company are situated at 11th street and East River, and their mains are laid through many of the streets of the first three mentioned districts, and their business is in competition with that of those three companies, viz.—the New York, the Manhattan, and the Metropolitan. Previous to the recent "letting" the New York Mutual lighted all the lamps on the line of their mains. In making bids for the public lamps for nine months, from April 1st, the New York and the Manhattan companies offered to light all the lamps in their respective districts for the sum of $12.40 per lamp—this to include lighting, extinguishing, and cleaning. The bid of the New York Mutual, for so many of the same lamps as were situated on the line of their mains, for the same time was $22.25 per lamp. The Metropolitan company bid only for the same lamps that they were previously lighting and offeered to light for $21 per lamp.

The Harlem, with no opposition gas company, bid for all the lamps in its district, and offered to do the work for $24.75 per lamp.

One fact must be remembered with reference to the Harlem company's mains. Many of them they have been obliged, by order of the Common Council in years gone by, to put down for miles and miles, in some cases through rock, where there was not, and is not now, a single consumer, simply for lighting streets. Undoubtedly, the reason for doing this was the fact that plenty of light is the cheapest and the best police. Another fact, with reference to this district, is that the expense for distribution must necessarily be greater here than in any other section of the city, owing to the conformation of that portion of New York Island.

At the same time a proposition was made by the New York and New Jersey Globe Gas-Light Company, Limited, to light, etc., not to exceed 2,000 lamps, in any part of the city, with naphtha, for the sum of $20 per lamp, for 9 months.

The awards were made, as stated in this JOURNAL, on March 16th, giving the New York and Manhattan companies all the lamps in their respective districts, and the other companies not being in competition, were awarded the same lamps they had before at the prices bid, with the exception of the Harlem company, from whom two thousand lamps were taken and assigned to the Naphtha company. This company manufacture their light on each lantern from naphtha contained in a small receiver, placed on one side, at the top. As this arrangement was to take effect April 1st, there has not been time yet to fully determine the practical value of these latter lights; but the same arrangement has been in use quite generally in New England, for outlying districts where there was no gas, and when they do not blow out, or get the lanterns too smoky, they answer the purpose intended better than oil lamps, perhaps. The price, however, is not much less than the average price bid for gas at the last "letting" in New York city—which would be $20.20.

It seems to us that the whole business of lighting New York street lamps is on a wrong basis. In the first place, the burners are too small, being required to burn only three feet an hour, under one inch pressure at the burner. Bearing in

mind that the light derived from different sized burners varies not *directly* with the consumption of the burner, but very *nearly* as the *square* of the amount of gas consumed; it would seem much better policy if economy has to be practiced in so essential a thing as light, to diminish the number of posts, and burn not less than five feet of gas an hour in each one that is used. If the city was to pay for the same amount of gas as it gets now, it would get more than double the amount of light, if the gas was burnt in this way.

In the next place, all gas, whether burned in street lamps or elsewhere, should be sold in the same way, viz.: by the thousand cubic feet, and all labor of every kind attending the lighting, extinguishing, cleaning, repairing, &c., &c., should be paid for separately as labor. In this way a definite idea could be obtained of the price charged for the gas itself, and it would not be mixed up with a dozen different items of labor, etc., which would puzzle a Philadelphia lawyer to separate and charge to their proper accounts.

PROVINCIAL GAS COALS.

We call the attention of our readers to a review in another column of the Report of the Department of Mines of Nova Scotia for 1876. So far as it relates to the subject of coals. Many of our gas managers are aware of the relative merits of these and our own coals, when quality alone is considered. But the item of price is an important one in connection with the *candle feet* of coals in fixing their value, and in making up the mind as to which is best to purchase, that item must be known.

We understand that both Penn and Westmoreland have been offerred lately at $5.50 in New York.

The combination made a short time since by the Pennsylvania Railroad and the Baltimore and Ohio, by which the country was quietly divided up, and prices for coal and freight fixed, seems to have come to grief. Gas companies about New York City seem to be well stocked, and don't care to buy just now. The price fixed for Penn etc., was $6.00, but during the past week, contracts have been solicited at $5.50. Province coals have been sold at $4.00 to $4.50 currency.

GAS-VALVES FOR STREET MAINS.

A good gas-valve for street mains has long been a consideration with gas engineers, and could such have been obtained years ago, when most of the gas-works in our principal cities were constructed, it is to be presumed that they would have been generally introduced in street mains for the purpose of shutting off the gas in cases of breaks, or leakage from other causes; but, more particularly, in cases of fire, when, from the want of them, the loss of gas is often very great, and the extinguishment of the fire very difficult. The difficulty which has been found has been to obtain valves which could be relied upon when buried for years in the ground in connection with street mains, to close tightly, and open and close easily when required. It is claimed for the Chapman Valve, advertised on last page, that it possesses these qualities.

The cost of street main valves to any gas-light company would be more than saved by preventing the loss of gas in cases of large fires, such as have, within a few years, occurred in New York, Chicago, and Boston, to say nothing of the loss of property arising from inability to extinguish gas flames in such cases, or the loss of gas to the company from breaks, and other causes of leakage, which ordinarily occur.

In the cities of the Eastern States the subject has received special attention; and street main valves, at the junction of streets, are being now very generally introduced. In Boston the number of these valves exceeds fifteen hundred. In many places their use has enabled gas-light companies to detect and remedy defects in mains, and thereby very materially reduce the discrepancy existing between the station meter and the meters of gas consumers.

THE PRICE OF GAS FOR PUBLIC LAMPS IN THE NEW YORK CITY PARKS.

On the 11th inst. proposals for lighting the public lamps in the various parks in this city, for eight months from May 1st, were received by the Department of Parks as follows, viz.:

New York Gas-Light Co.	...	$12.00 per lamp.
Manhattan " "	...	12.00 "
Nr Y. Mutual " "	...	10.00 "
Metropolitan " "	...	17.50 "
Harlem " "	...	20.00 "
N. Y. and N. J. Globe (Naphtha) Gas Co.	.....	17.00 "

These lamps burn all night, and the number of hours of burning for each lamp in the eight months bid for will be about 2,450. The burners are three feet per hour.

New City Gas Company of Montreal.

The annual meeting of the New City Gas Company was held last week, at the works, Ottawa street, there being a large attendance of stockholders, Mr. Andrew Wilson, Vice President, occupying the chair; Mr. Scriver, Secretary.

In taking his seat the chairman expressed his deep regret at the recent decease of their President, Mr. Henry Thomas, a gentleman who had been fifteen years a director and seven years president, and who in his position had done the company good service. He had also aided the company very materially at Quebec, with the assistance of Mr. Joseph, when they were endeavoring to obtain amendments to their charter. He had succeeded in getting improvements to the works at very small cost; he had conducted the office well; he received furious customers—and at times there were such—most courteously, and, moreover, made no enemies. The company deeply deplored his loss, and sympathized with his wife and family in the affliction which they sustained. He had in his hand a resolution which he thought should be unanimously adopted, as he knew it would be.

Resolved—"That the stockholders of the New City Gas Company, now assembled, do express their deep regret at the death of the late President of the company, Henry Thomas, Esq., whose long services were of the greatest importance and value, and whose intercourse with them was always of the pleasantest description.

"They also desire to assure Mrs. Thomas and the family of their late President of the great sympathy which they feel for them in their heavy bereavement, and request the board to convey to Mrs. Thomas this intimation of their respect for their late President, and their sense of her great affliction."

The annual report showed total expenditures $213,149.87, and total receipts £405,024.61. The receipts for gas rents amounted to $325,025.50, and the nett receipts, from street-lighting, $18,983,46. The value of coke and breeze sold during the year, with what remained at present on hand, was set down as $49,321.37. On the other side of the account, among other items, the cost of coals carbonized had been $114,668.46; salaries, $20,046.88; wages, $37,648.26; corporation taxes, $9,152.39. The paid up capital stock was $1,798,292.

Mr. Mossette and Mr. D. J. Craig having been appointed scrutineers—

On motion of Mr. R. Anderson, it was resolved that the annual report and accounts now submitted, be received and adopted.

In answers to questions put by shareholders.

The chairman explained that the great bulk of the open accounts were due by the government, and the corporation, and would come in in due course.

In reply to Mr. Mitchell—

Mr. Jesse Joseph said that the $79,779.14 was the amount at rest account. This was in addition to the land which the company could sell, over and above what was required and which would fetch $180,000. The whole of the property at Hochelaga had been bought for $40,000. It was estimated to be worth seventy-five cents on the river front, the rest thirteen cents. An arbitration was now going on with the government for the river front. They had paid seventy cents for a piece, a cheque for which was expected in a few days.

In answer to Mr. Mitchell—

The chairman said the company owned a million feet of property on the land and 32,000 on the river side.

Mr. Anderson—We have thirty acres irrespective of the land on which the works stand.

Considerable discussion arose as to the advisability of establishing a reconstruction fund, and the advisability of reducing as much as possible the price of gas, the carrying out of which latter suggestion the chairman said the company already contemplated. It was shown that there were only four or five places on the continent where gas was sold cheaper than in Montreal, where, it was explained by Mr. Cathels, the gas was several candles better, and where, owing to the climate, it was more expensive to produce it. The chairman stated that last year the company manufactured 195,000,000 of feet, getting paid for 142,333,000 feet.

At the request of Mr. Crawford—

The chairman explained that the directors had, with Messrs. Holton, Workman, and Masson, an interview with Mr. Laflamme on the subject of the proposed new bill in regard to gas purification which, if carried, would compel this company to put up additional buildings, and make other expenditures to the amount of at least $100,000 without giving any adequate return to the public. They had pointed out the objectionable features of the measure, and had hopes that it would not be pressed.

Mr. Simpson brought up the subject of the inadequate ratio of the increase of the revenue to the increase of capital of the company, when it was explained that the company now had facilities for supplying gas to a city three or four times the size of Montreal.

Votes of thanks were passed to the directors and officers of the company for their services during the year, and $4,000 were voted to the family of the late President to mark the appreciation of the shareholders of the services rendered by him.

The election of directors, to replace those who retired, had the following result:—Messrs. John Ostell, Mr. Masson, Alex. Urquhart, and W. Macdonald.

A long discussion took place on various subjects connected with the interests of the company, and the meeting adjourned to attend the funeral of Mr. Thomas.—*Montreal Herald.*

Provincial Gas Coal.

We have received the Annual Report of the Department of Mines of Nova Scotia, for 1876. This work has been prepared by Henry S. Poole, Esq., F. G. S., Inspector of Mines, and contains a vast amount of valuable information touching the operations of the different mining companies located in the Dominion of Canada.

In addition to coal, which is the leading interest, the report covers some very interesting statistics of the productions of gold, lead, copper, iron, gypsum, etc., all of which give promise of extensive development in the future.

Our present object is to lay before our readers some extracts from the report having special reference to the gas coal productions of the Dominion. The Provincial coal companies operate their mines under leases from the Government, which derives a revenue of ten cents per ton on all sales of round or screened coal. There are now existing 160 leases to different mining companies, and private individuals, covering an area of 239¾ square miles. Of these leases only 21 are actually working, their operations covering an area of only 60½ miles, leaving three-fourths of the mining area untouched.

The coals produced from these mines vary materially in quality, and only some half dozen have any reputation as gas coals—these are the Block House, Glace Bay, International, Lingan, and the Cape Breton company's coals, all located in Cape Breton. The Pictou coal, formerly employed extensively for gas manufacture, has passed out of the catalogue of gas coals.

The following table gives the total production of coal for the last five years—

Year.	Produce.	Sales.	Colliery. Consumption.
1872	880,950	785,914	101,341
1873	1,051,467	881,106	108,398
1874	872,720	749,127	119,592
1875	781,165	706,795	124,110
1876	709,646	634,207	113,788

The sales of 1876, say 634,207 tons, were distributed as follows:

Markets.	1876.
Nova Scotia	225,658
Quebec	117,303
New Brunswick	101,890
Newfoundland	51,742
P. E. Island	46,908
United States	71,634
West Indies	17,971
Europe	1,101
Total	634,207

showing a falling off in sales of 62,588 tons from 1875, and a deficiency of 246,899 tons, or nearly 30%, from 1873.

Summary of coal sales in Nova Scotia from 1785 to 1876, inclusive—

1775 to 1790	14,349	1831 to 1840	839,981
1791 " 1800	51,048	1841 " 1850	1,533,798
1801 " 1810	70,452	1851 " 1860	2,399,829
1811 " 1820	91,527	1861 " 1870	4,927,339
1821 " 1830	140,820	1871 " 1876	4,353,567

If 13 per cent be allowed for colleiry consumption, the total output has been 16,297,562 tons.

The exports from Nova Scotia to the United States from 1840 to 1876, inclusive, have been—

Years.	Tons.	Duty.
1859	98,173	24 % ad.
1851	116,274	"
1852	87,542	"
1853	120,764	"
1854	139,125	Free.
1855	103,222	"
1856	126,152	"
1857	123,335	"
1858	186,743	"
1859	122,720	"
1860	149,289	"
1861	204,457	"
1862	192,612	"
1863	282,774	"
1864	347,594	"
1865	465,194	"
1866	404,252	$1.25
1867	338,492	$1.25
1868	228,132	"
1869	257,485	"
1870	168,180	"
1871	165,431	"
1872	154,092	.75
1873	264,760	"
1874	138,335	"
1875	89,746	"
1876	71,634	"

It will be noticed that to the United States, the exports decreased 18,112 tons and in all only amounted to 71,634 tons. They are now not of so much consequence as the trade with New Brunswick or the islands of Prince Edward and Newfoundland conjoined. The condition of this branch of the trade was so fully explained in Messrs. Perkins & Job's statement in the previous report that it does not call for further comment this year.

The increased sales of 1873 in the United States arose mainly from the sudden advance in the price of American gas coals in the spring of that year, leading to large importations from Cape Breton; the decline in the trade since 1873 is largely attributed to the comparatively low prices of American coals during these latter years, coupled with the uncertainty attending the cost of the Provincial coals, arising from the fluctuation of gold and irregularity of water freights. The following table will show the contract prices of American and the average cost of Provincial coal, at New York, for the last five years:

Year.	American	Provincial.
1872	$7 50	$6 25
1873	8 25	7 00
1874	7 50	5 68
1875	6 50	4 75
1876	6 00	4 50
Average for the 5 years	7 15	5 62cur'ncy

The prices for 1876 no doubt represent the minimum at which these coals can be delivered at New York for any large quantity, and any change will likely be towards an advance—unless, indeed, the renewal of the reciprocity treaty, of 1854, should once more admit the Provincial coal into the States free of duty. The main argument in favor of such a treaty is to be found in the fact that large exportations of American coals are now made to Canada where it is admitted duty free. The trade has grown up within the past five years, and has now assumed proportions that bid fair to make that market one of the most important outlets for American bituminous and anthracite coals.

In 1876 there were imported into the Dominion, from the United States, 625,203 tons of coal, valued at $2,824,975; this quantity was distributed among the different provinces, as follows, viz:

Shipped to Nova Scotia	5,096	tons
" " New Brunswick	24,059	"
" " P. E. Island	314	"
" " Quebec	122,673	"
" " Ontario	472,716	"
" " Manitoba	282	"
" " British Columbia	63	"
Total	625,203	tons

Included in this quantity we note 3,000 tons Cannelton Cannel, from West Virginia, and 2,500 tons American caking coal, from Pennsylvania, imported into the Lower Provinces for gas manufacture. Contrast this exhibit with the small shipments of 71,634 tons of Provincial coal to the States for 1876, and it will be acknowledged that our Provincial neighbors are not altogether unreasonable in their desires for a removal of the present tariff on their coal.

Mr. Poole discusses freely the subject of spontaneous combustion of coal, and as that subject has attracted the attention of our large consumers, we give some extracts from his remarks thereon. He says—

"The statement that nearly all Cape Breton coals heat under certain conditions may be new to the general public, but it is not so to large consumers, who are also not ignorant that nearly all bituminous coals are liable to spontaneously ignite, and that, therefore, the question at issue is merely one of comparative freedom from a dangerous liability.

"The Admiralty have tried the steam coal from Cumberland, Maryland, and although its excellence as a steam coal is acknowledged, its use has been discontinued on account of the danger attending it. On the contrary the Pictou coal was favorably reported on. The experience of the barque 'Senator,' shows that the semi-bituminous coals of Broadtop and Clearfield, either one or both, are not perfectly safe; *while the actual loss of a vessel from spontaneous combustion of Nova Scotia coal has yet to be recorded.*

"Persons acquainted with the coal trade are probably aware from which mine came the coals referred to in the cases instanced in the report of heating on shore, and they may also know that some coals bear a better name in the general market than those from other pits on the same seam.

"Designing dealers have proclaimed the danger attending the use of the coals of others to raise, if possible the character of their own; but as all such subterfuges are, sooner or later, exposed and often reflect back on a whole district, an honest policy in the long run pays the best. If there be any natural want in the quality of our coals, and crude methods of handling are practiced and perpetuated in spite of the experience of others, it is better to acknowledge them and meet or remedy them, if possible, than to continue to shut our eyes and deny their existence.

"Every one will allow that coals vary in character, that some are better suited for gas, some for domestic, and some for steam purposes, than others; again, that some are excellent for specific purposes, if speedily used in the neighborhood of production, while others of inferior quality are better for the same purpose if both are subjected to much handling and long confinement on shipboard. Knowing, then, these things, what we want to get at is the proper position which the several coals should occupy in the open market. If our gas coals come into competition with other gas coals of a well recognized grade, the mere saying that they are as good will not make them so. We know that Penn and Westmoreland coals bear a higher character and are preferred at some gas works because they contain a less percentage of sulphur than the run of Provincial coal that goes to Boston and New York, but it is also known that they are none the less liable to spontaneously ignite, and that Cape Breton coal has one advantage over them, which is that it makes better coke.

"As to the percentage of sulphur in our gas coals, an average of fourteen analyses gives 2.05 per cent., (vide, Table of Analyses, p. 47, Report for 1875) an average certainly higher than that of the best American coals that find their way to the Eastern markets, but under that of the general run of Western coals. The Table was published to refute the sweeping assertion of Prof. Chandler, of New York, that Provincial gas coals contain from three to five per cent. of sulphur. Simply because the run of our coals that are sent to New England and New York, to compete with the best American, yield a higher percentage of sulphur, they have been underrated, and such general statements as that of Professor Chandler accepted without investigation.

"Still, a creditable position is not to be maintained by mere denial of shortcomings and by ignoring imperfections. What care will do has been shown by the different characters borne by coals from the same seam, but under different management; and every credit is due to the management that achieves such a distinction. Whether that complete preparation which the nature of the several coals will admit of has yet been effected, is a matter of doubt.

"The enquiry of the recent Royal Commission, appointed to consider this subject, established some general facts of value to all interested in the coal trade. Although in a way they are not new, still being the result of cumulative evidence they may be considered authoritative, and, as such, worth noting here.

"1. That certain descriptions of coal are intrinsically dangerous for shipment on long voyages.

"The degree of danger is not proportionate to the percentage of sulphur contained in the form of iron

pyrites. The evidence on this side of the Atlantic shows that Cumberland coal, the purest from sulphur that is shipped, has been condemned by the Admiralty. Albertite, perfectly free from sulphur has yet taken fire. Then the liability to heat of flour dust, freshly burnt charcoal, lamp black and oiled cotton waste, all declare that spontaneous combustion may take place in carbonaceus matter free from sulphur.

"2. The effects of moisture on coal as tending to promote spontaneous combustion are most evident in those containing iron-pyrites. The absorption of moisture by mineral substances of laminated or porous structure, through which pyrites are disseminated, promotes the oxidation of the latter by bringing the atmospheric oxygen, which is dissolved by the water, into more intimate contact with the oxidizable material."

"3. The breakage to which coal is subjected is largely dwelt on and the different methods of shipping discussed. My remarks in late annual reports on the handling of coal are borne out by this portion of the report."

In common with all other bituminous collieries, those in Nova Scotia find difficulty in disposing of their fine coal. In 1876 14,748 tons were shipped to the United States, where it is allowed to come in as "culm of coal," paying a duty of 40 cents per ton gold; it is used as a cheap fuel for steam purposes, costing about $3.00, currency, per ton, delivered at New York or Boston.

Mr. Poole remarks on this subject—

What to do with the waste coal is a serious question at several of the collieries in Cape Breton. It is felt that while large coal is in such small demand at the present low prices, it is impossible to find a market by water for all the small and inferior coal. That there is little or no local demand, is indicated by the heaps of slack and waste coal about the pits and along the lines of railway at some of the collieries.

"If it should only be found that the Wootten plan of consuming fine coal under boilers, as has been tried with apparent success by Mr. Hoyt at the Acadia colliery, is really as satisfactory as it appears to be, it will effect great economy. The method was devised and perfected for the utilization of anthracite coal dust as it is, without any preparation; and so successfully that the results, it is stated, are almost equal to those obtained from the use of lump coal.

"The plan consists of injecting air into a closed ash pit by means of a steam jet passing through tubes. The mingled air and steam pass up through perforated plates on which the fuel is spread to a depth of some three inches. The plates are of wrought iron and the perforations are about three-eighths of an inch in diameter on the upper face and larger on the lower, and from two to three inches apart. The fuel is frequently rabbled to prevent the formation of clinkers and to aid the removal of the ashes.

"Whether the dust from the caking coals of Cape Breton could also be utilized by this method is open to doubt; but if further trial at the Acadia colliery confirms the present belief in its successful application with the dust of that coal, experiments should be made with that of Cape Breton, since the percentage of waste coal there is greater."

As many of our readers may not be familiar with the gas producing qualities of these coals, we give the following as the practical results obtained from those best known in the States:

	Made in 1867.	Made in 1871.
Maximum yield, time 3h 15m	10.217 c. f.	10,316 c. f.
Candle power on yield of 9,500 cubic feet	17.32	16.53
Coke	40 bushels.	wt. 1,460 lbs
Gas purified per bush of hydrate of lime	2,306 c. f.	2,840 c. f.
Volatile matter	40.8	39.0
Fixed carbon	57.7	57.5
Ash	1.5	3.5
	100.	100.

Coke of excellent quality, making strong fire but little clinker or ash.

The Provincial coal companies referred to in the commencement of this article have each their own shipping port, open to navigation from March to January, with facilities for supplying an almost unlimited quantity of coal at short notice. This ability to enter the markets of the United States depends almost entirely upon the relative cheapness of the coal, to the consumers, as compared with the standard American coals. For the past five years they have been able to maintain an average margin of $1.50 per ton in their favor; and with the general depression in ocean freights likely to rule during the current year, they will have no difficulty in sustaining this difference.

On the Volumetric Determination of Sulphur and Ammonia in Illuminating Gas, with a Description of the Apparatus Employed.

[A paper read before the American Institute of Mining Engineers at the Philadelphia meeting, October, 1876.]

By H. E. Sadler and B. Silliman, of New Haven, Conn.

[Concluded from page 125.]

OTHER PRODUCTS OF THE COMBUSTION.

Aside from the acids and bases, no substance among the products of combustion was positively identified. Potassium iodide paper, moistened with starch liquor and suspended above the marbles, as in the condensing tube, immediately showed the presence of an oxidant, probably hydrogen dioxide or ozone, since nitrous acid was hardly possible after passing this alkaline solution. Blue litmus paper, however, was here reddened, but rapidly bleached. The reddening was probably due to carbon dioxide.

A portion of the drip from each of the last eight experiments was preserved in tightly stoppered bottles, and at the conclusion of the experiments tested for oxidants with one-twentieth normal sodic hyposulphite and iodine solutions. No oxidation of hyposulphite took place in alkaline solution. Upon acidifying with hydrochloric acid, from one to two c.cms. were found to be oxidized. After adding excess of hyposulphite and allowing the solutions to stand—Nos. 12, 13 and 14 over night, and the rest for one hour—the following results were obtained- Since no oxidation took place in the alkaline solution, it was inferred that nitrous acid was the oxidant, and not hydrogen dioxide nor ozone, and the results are accordingly expressed in grains of nitrogen oxidized in the combustion of 100 feet of gas:

Table H.

No 12	0·988	equal in saturat.	power to	0·86	grs. sul.
" 13	0·739	"	"	0·65	"
" 14	0·706	"	"	0·62	"
" 15	0·415	"	"	0·36	"
" 16	0·411	"	"	0·36	"
" 17	0·354	"	"	0 31	"
" 18	0·292	"	"	0·26	"
" 19	0·244	"	"	0·21	"

These results seem to indicate so unquestionably that much the greater part of the oxidation was due to the atmospheric air absorbed by the liquid that it is barely worth while to recall in this connection the Nessler determination of the ammonia in No. 12, 9-10 grain per 100 feet, equal in saturating power to 0·84 grain of sulphur. The above table shows nitrous acid in No. 12 equal to 0·86 grain of sulphur.

FURTHER SUGGESTIONS.

The possibility of avoiding the complication arising from the arrest of varying quantities of nitrogen acids and of further simplifying the working of the test by substituting pure water for standard alkali in the condensing tube, is suggested by a consideration of the fact that sulphuric oxide possesses so great affinity for water, and that, when once in solution, especially if the proportion is large, only slight traces of acid vapors are given off, even under the most favoring circumstances.

It may be true that, in the combustion of sulphur, sulphurous and not sulphuric oxide is the body immediately produced; but it is rendered probable by several experiments, most of which have been detailed above, that travelling in company with the powerful oxidants produced by the combustion of hydrocarbons in air, no considerable quantity of sulphur would enter the combustion tube without being completely oxidized—a view which receives confirmation from the important experiments of M. Verigo, communicated to the *Academie des Sciences* by Berthelot, and reported in *Comptes Rendus* for April 24, 1876.* If this inference prove unfounded, we have still a safeguard in the comparatively ready solubility of sulphurous oxide in water with which the products of combustion are very thoroughly scrubbed in the condensing tube; and, as a last resource, the addition to the scrubbing water of a small quantity of standard solution of borax, which is a great solvent for sulphurous oxide.

While still under the impression that sulphuric acid was the chief substance to be met with, some experiments which depended for success upon the power of water to arrest sulphuric oxide, as suggested above, gave the following results:

Table I.

No. 1	14·93 grains	S. per	...100 feet
" 2	31·52	"	" ...100 "
" 3	17·51	"	" ...100 "
" 4	10·51	"	" ...100 "
" 5	10·48	"	" ...100 "
" 6	18·60	"	" ...100 "
" 7	18·43	"	" ...100 "
" 7 Letheby	15·34	"	" ...100 "

The products of combustion were bubbled through water, and bromine added continuously by an automatic arrangement to oxidize the sulphurous acid. The exhauster, a Richards pump, used to draw the gases through the water was insufficient in capacity and uncertain in its action, and, accordingly, only a small quantity of gas, from two-tenths to four-tenths of a foot, could be burned for each determination. The volumetric estimation of the sulphuric acid was then obtained by expelling the free bromine with heat and the hybrobromic acid by digestion with silver oxide or better with silver carbonate. When this had settled, an aliquot portion of the supernatant liquid was withdrawn for titration, but as it was found to contain dissolved silver salts sufficient to obscure the reaction between hæmatoxylin or cochineal and an alkali, they were removed by precipitation with hydrogen sulphide, the excess of which was in turn expelled by boiling. The remaining free acid was titrated with standard alkali. In dealing with such small quantities the probable error was of course very large, and it was thought useless to make comparative experiments with the Letheby test until the apparatus should be put in condition to burn a larger quantity of gas for each determination. Before so amending, the whole process was abandoned in favor of the alkali test, and accordingly we have but one comparative experiment, No. 7. The general results afford some indication, however, of what might, under more favorable conditions, be accomplished with water as a scrubbing liquor.

RESUME.

In reviewing what has been accomplished, an advance in two directions seems possible:

First—An apparatus has been devised for bringing gases into contact with a liquid, which is an improvement on bubbling them through the liquid contained in a Woulfe bottle in three respects. The necessity for an exhauster or blower is avoided. the gas is completely broken up, affording a more intimate contact and the proportion of the two may be so regulated as not to flood the products.

Second—The gas engineer is provided in this apparatus with a complete indicator of the working of his purifying processes, except the removal of tar.

* Since this paper was read, our attention has been called to the fact that Chas. Heisch, F.C.S., had already observed the absence of sulphurous acid (London *Journal of Gas Lighting*, etc., Dec. 29th, 1874, p. 856), and in the Oct. number of the *American Chemist* are reported some experiments by W. C. Young, F.C.S., leading to the same conclusions.—Authors.

is continuous. There is no instant of the day or t when the quantity of ammonia and sulphur pas- into the holders or street mains is not accurately sured.

is ever ready, and if the condensers and scrubbers w an abnormal quantity of ammonia to pass, or purifying boxes become overworked, and there pes traces of hydrogen sulphide, which every en- er now intends to remove, the test-papers give ediate notice, and the amount of damage done be quickly determined.

is complete. The presence and quantity of am- nia, and of hydrogen sulphide and the other sul- r compounds are indicated, and the possible pres- e of carbon dioxide; for on account of the well wn power of that body to decompose moist cal- m sulphide, setting hydrogen sulphide free, no no- able quantity of carbon dioxide can pass the puri- s without the previous escape of hydrogen sul- ide.

It is rapid. Ten minutes is ample time to deter- ne both the ammonia and sulphur.

It is inexpensive. Fifteen dollars will provide all the sware for the apparatus. The breakage is small, d the chemicals cost comparatively nothing.

Finally, it is simple in theory and practice. To rk it successfully requires no knowledge of chemi- theories, and the needful manipulations can be eas- acquired by a little care and attention to a few sim- directions.

H. E. Sadler.
B. Silliman.

DISCUSSION.

Mr. Birkinbine.—I would like to ask Mr. Sadler w often it is the practice to determine the sulphur d ammonia in the gas works, and also whether the terminations are made at or about the time of charg- g, or about the time the charges are used up.

Mr. Sadler.—Your question is, how often observa- ns upon the sulphur and ammonia are made in gas orks?

Mr. Birkinbine.—Yes, sir; but I speaking now par- cularly in regard to this apparatus. Are observations ade once in twenty-four hours, or are they made at very charge?

Mr. Sadler.—Either once in twenty-four hours, or e is found to be most convenient. If there is any eason for making observations once in every charge, may easily be done.

Mr. Birkinbine.—I think, Mr. President, that the entlemen have given us, by this process, a more ac- urate determination of the exact quantity of sulphur nd ammonia in gas, than by any other mode which e have yet used.

I would like to ask Mr. Sadler if he has made any eries of experiments covering the operation of the orks—that is, while the works were in their nomal cting condition; if his connection with the works as been such that he has been able to keep any rec- rd which will enable him to give us information n regard to the character of the gas from day to day?

Mr. Sadler.—As far as my experiments have gone and there have been in all, I think, considerably more than a hundred of them), the daily variations have not often been large. However, a variation of ten grains in a day—from thirty to twenty—is not un- known, and in the determinations which are reported by the referees, and the accuracy of which our experi- ments have given me no reason to suspect, the varia- tions are very much greater. A variation of 50 to 75 per cent. is not unknown.

Prof. Silliman.—The variation of ammonia is con- siderably greater than that of the sulphur. During the course of these observation it was more than once, I may say frequently, asserted by the engineer in charge that he was sending out no ammonia; that the gas went from the works free of ammonia. But there was no time when the gas did not immediately discol- or litmus paper. This discrepancy was due beyond doubt to an insufficiency in the means of observation employed.

Barbadoes Gas Company.

The *Barbadoes Globe*, in its account of the Agricultural Society's Annual Exhibition recently, remarks that "Mr. Moorhouse, the enterprising manager of the ges works, occupied a department of the hall with some models of gas-fittings and meters, and exhibited a stove of his own invention. There was a display of manures from refuse lime, und used in gas manufacture, which is worth the attention of the planter. This department formed an attractive feature in the Exhibition. There were some prodigious beans, grown in the yard of the gas company's works, in Bay street—a good specimen of the nutritive properties of the manures from gas manufacture refuse, which the manager desires to introduce to the notice of the planters."

The *West Indian*, also speaking of the Exhibition, says: "The chief novelty and a center of attraction was the corner appropriated to the exhibition of gas, and occupied by the Barbadoes Gas Co., represented by their engineer, Mr. R. E. Moorhouse. It consisted of various articles of interest to all classes, both young and old. First was the 'Model Parlor Gas Stove,' illustrating the combustion of gas at a moderate heat. Then came the mechanism of dry and wet consumers meters in glass cases, which, when at work, drew a crowd of admiring spectators. The art in works of brass, by Messrs. W. Blews & Sons, of England and Moscow, was favorably displayed. Punch smoking a cigar, and a prancing horse, driving out sparks of fire from its nostrils, were a special attraction and treat for the young folks. An experimental meter with clockwork—a piece of perfect workmanship, was calculated to afford information concerning the mode of measuring the consumption of gas. The excellent quality of coke, and tar and other products, were objects to the planters and others for their practical uses. As there were no prizes offered for this class of products, the judges unanimously made honorable mention of them."—*Journal of Gas-Lighting.*

Influence of Pressure on Combustion.

M. Wartha has observed the burning of six stearine candles in free air, and in an iron case under a pressure of 1·95 atmospheres. They burned under this pressure with a flame of 9 to 12 cm. long, and gave much smoke; their luminous power diminished, while the flame assumed a yellowish-red color. The decrease of weight after one hour of burning was found to be less than in burning in free air. This last result is opposed to the observations of Frankland, who has affirmed that the consumption of the burning material of a candle, or the like, is not perceptibly dependent on the pressure of the medium in which the combustion occurs. It is supposed that the difference of pressure in Frankland's experiments (on Mont Blanc and at Chamouny) was not sufficiently great to give a distinct difference in consumption of the burning matter. M. Wartha further put a candle to burn under an air pump receiver, with special apertures, and, with increasing rarefaction, the flame was seen to enlarge, and its luminous power to diminish. At a pressure of 90 cm., the greatest rarefaction produced, the luminous power was quite gone, and the flame, which now assumed three-fold size, appeared to consist of three parts, an inner bluish-green cone with a violet sheath, and a weakly violet mantle. The diminution of the luminous power in this case M. Wartha explains by the fact that under less pressure less of the products of combustion are separated in the form of soot.—*Nature.*

Single Leather Belting, when new, weighs about 60 lbs. to the cubic foot; a strip one foot long and one inch wide weighs about 0.068 lbs.—*Polytechnic Review.*

Foreign Carriages failed to stand the intense heat at the Centennial Exhibition, as well as those of American build. Our panel and wheel stock vastly excels the European.—*Ibid.*

Report of the Proceedings of the New England Association of Gas Engineers.

[OFFICIAL]

[Continued from page 123.]

Mr. Neal—Mr. Sherman called upon me yesterday, and informed me that he intended to present the paper which he has just read, and suggested that it would be well if papers were prepared a sufficient length of time before the meeting at which they were to be read, to allow a suitable notice to be given by the secretary to the members of the Association. This would give them an opportunity to investigate the subjects themselves, and to prepare figures and facts bearing upon those subjects to be presented to the meeting. Thus, the discussions which might follow, would be of a more practical and instructive character. I have given considerable attention to testing meters of late, as they are removed from time to time and brought into our repair shop. Many of our consumers insist that our meters run fast but never slow. This is a mania with them, and it is extremely difficult to cure them of the malady. Of two hundred and sixty meters lately tested under my direction, sixty-three were 4 6-10th per cent. fast: one hundred and forty-five were 3 9-10ths per cent slow; forty-one were correct; and eleven had ceased to register. This is a small number compared with the number of those in use by us, but these figures are sufficient to show that the gas consuming public are not so much imposed upon and defrauded as one, unacquainted with the facts, might be led to infer at hearing their foolish and groundless accusations and complaints so often made against gas companies, whose officers all the while are striving to serve their customers honestly and fairly.

The President—If there are no further remarks to be made on this subject, we will now hear what Mr. Lamson has to offer on the subject of "Burners."

ON BURNERS.

Mr. President: I have prepared no paper, and I had no idea of speaking upon this subject until yesterday. Having made some few tests with new burners, just obtained from Sugg, it occurred to me that the tests, hasty and imperfect as they were, might be of interest to the Association.

Mr. Greenough has often called my attention to that clause in the Statutes of our State which relates to the tests of the illuminating power of gas, which is as follows:

"Illuminating gas shall not be merchantable in this Commonwealth which has a minimum value of less than 12 candles, in a burner consuming five (5) feet per hour."

That is, shall give a light, as measured by the ordinary photometric apparatus in use, of not less than twelve standard sperm candles, burning 120 grains per hour. Every gas is to be tested with the burner, and under the pressure best adapted to it, and the result shall be calculated at a temperature of 60° Fahrenheit.

The point being that *every gas shall be tested with the burner best adapted to it.*

This matter of testing gas, and the whole matter of state inspection, etc., is before the committee on mercantile affairs at the present time, and it is to be hoped the law will be allowed to remain as it is, especially that part of it which relates to the tests of illuminating power. My figures will show the value of that clause of the law which I have quoted.

At various times when this subject has been argued before committees in our state and city governments, reformers (?) who have not fully understood the subject, have urged the adoption of one standard burner for the testing of all gases in the state, and by this standard burner, of carefully prescribed proportions, all gases, whether of a high or low grade, were to be judged.

Nothing could be more unfair to the gas companies. If a 16-candle burner were adopted as the standard, then the 14 and 15-candle gases would be recorded as even poorer than they were, while the gases of an

18 or 19-candle grade would lose much of the credit of that richness, which it had cost so much to produce.

Whatever the gas, whether it be good or bad, of a high grade, or a very low one, it is but fair that it should be faithfully represented as just what it is.

Therefore, if five feet per hour is the rate prescribed for a test, we should certainly have the right to burn that five feet in such a burner as will bring out its value most perfectly; whatever the light obtained in such a test, it is certain that it could not have been obtained if it had not been in the gas.

Mr. Lamson here produced various burners, and explained them, stating that the Boston Gas-Light Company, had just imported two full sets of Sugg's improved burners, which were very perfect in their construction.

The set was adapted to various grades of gas from very low to very high.

The following table was read as tests of the *same gas* made with various burners.

The pressure was taken just under the burner, of course, for proper comparison; as part of the burners had governors, the pressure should have been taken at the tip of the burner, but this, at the time, was impossible;

The second column gives the rate at which the gas was burning to give a proper flame; the third column is the candle power reduced to five feet of gas and 120 grains of sperm per hour.

Burner.	Pressure. Inch.	Rate.	Illuminating Power at 5 feet of gas, 120 grs. sperm.	Remarks.
1. Sugg (F)	7	4.96	19.00	see below.
2.	7	4.76	16.28	edge.
3. Carcell	7	4.70	17.55	flat.
4.	7	4.77	16.66	angle 45°
5. Common house Argand	7	5.04	13.88	in general use in Boston.
6. New London Sugg	1	5.04	18.80	see below.
7. 15 hole Argand, lava tips	3-32	5.04	17.26	
8.	7	4.26	19.66	angle 45°
9. Christiania	7	4.32	20.25	flat — see below.
10.	7	4.22	17.36	edge
11. 30-hole Argand	7	5.09	13.75	
12. London Sugg, with self acting governor	7	4.54	21.13	see below.
13. Common	7	4.86	14.53	edge
14. Metal	7	4.86	15.94	angle 45°
15. Fishtail	7	4.92	16.80	flat
16. Common	7	4.50	16.66	angle 45°
17. Batwing	7	4.56	15.16	edge
18 Lava tip	7	4.53	17.65	flat

No. 1. Burner F is one of the new set of Sugg's, adapted to this grade.
No. 6 is one of Sugg's best before these last. I have used it a long time. Name—New London Sugg.
No. 9. Christiania. This is one of the new set; it is a flat flame, with a self-acting governor.
No. 12. London Sugg, with self-adjusting governor. Several tests were made with this burner to be certain that the result was correct.

The Assseiation having voted to dine together at six o'clock in the evening, a committee was appointed to make arrangements for the dinner.

Mr. M. S. Greenough was next called upon and said: As far as my own experiments have gone I am very glad to be able to confirm all that Mr. Lamson has said. The subject of testing burners has attracted considerable of our attention during the last few weeks. We have put a new 60-inch bar photometer into my room at the office in West street, and have also imported one of the new Illuminating Power Meters from Mr. Sugg; besides two complete sets of his burners. We have made a number of tests on the variation of the candle power and the results have puzzled us very much.

[Mr. G. here described the burners and the results which Mr. Lamson and himself had obtained in making the experiments, and offered to exhibit the apparatus to any one interested in the matter.]

Mr. President and Gentlemen—I, also, have prepared no paper. I was asked some time ago by Mr. Neal, if I could not prepare one to be read before this meeting. I told him then that I would do so with pleasure on some experiments made on the heats of clay retorts. I will give you the figures, with pleasure, but they are not quite so satisfactory as I then hoped for. What has been attempted is this:

We frequently hear that such a man is running his retorts at a low heat or high one, or some expression of that kind: that he is using so much coal and coke, making so much gas, &c., &c.

Now the only possible gauge we have of the heat at which he runs his retorts is the quantity of gas from his coal, and, if the coal is different from that to which we are accustomed, we have really no comparative gauge at all. It therefore seemed of advantage to run a series of charges in the experimental bed which we have at our works, taking very careful account of the quantity of gas and coke made and coke used in the fires, and ascertaining as well as possible, the heat at which the retorts stood during the experiment. In making this test I used a formula, which will be found in almost any of the books which treat of the method of calculating specific heat. It is this—

$$x = \frac{(O - t^{\circ})^{\circ} W}{(T - O)^{\circ} w}$$

which, by a transposition of terms, becomes—

$$T = \frac{W(O - t)^{\circ}}{wx} + O^{\circ}$$

and, when put into English, amounts to this, that you can obtain the temperature of any object whose weight and specific heat you know, by immersing it in a given weight of water, and noting the temperature of the water before and after immersion. T, then, is the temperature of a piece of flat iron about half an inch thick, (with an eye in it to take hold of), and weighing just five pounds; W is the weight of water, which is forty pounds; t° is the temperature of water, before immersion of the iron, and O° after; x is the specific heat of the iron, I have taken this at .126, but as it changes with the temperature to which it is exposed, I am not certain of this, though I have taken what is believed to be about right.

If the specific heat of iron at high temperatures were positively known, the experiments would be as accurate as I think it possible to make them: but now they are liable to criticism on that point. They are, however, good enough for purposes of comparison; and, if others would make similar experiments with their settings, and let the results be known, we might get one step nearer to settling the vexed question of the best method of building our beds. I have had a diagram made here, which is large enough to be seen across the room, showing the results of these experiments.

(Mr. Greenough here explained the diagram, showing the results, and also explaining to the Association how the experiments were made.) For this diagram see table on page 102, vol. xxvi, (March 16th, 1877). American Gas-Light Journal.

In conclusion Mr. Greenough said:—

Of course it is not necessary to say anything to these gentleman as to what might occur to render apparently inaccurate, experiments like these. There are so many things which come into play, which will alter the temperature slightly, that I know you will make allowance for them. In conclusion I wish to make myself perfectly plain on one point, and say that there is no originality claimed for this principle of obtaining the heat of retorts. I dont know but that it has often been done elsewhere; possibly there may have been similar experiments made in this country, and I believe there have been some abroad. I can, however, say that if such experiments had been made, and the figures had come to my knowledge, I should not have taken up any of your time on this subject. In answer to several questions Mr. Greenough said:—

Of course these experiments are not to be considered as scientifically accurate. The loss of heat in carrying the iron from the retort to the water, the radiation of heat from the top of the water &c., have been disregarded. If the thing were to be done on a smaller and more accurate scale, allowance should be made for the vessel containing the water and the radiation from it, according to the material of which it is composed, and its weight; but, taking it on a large scale in this way, it is regarded as close enough for our purpose. The charges were as nearly the same as possible. I have lately read in some of the English journals, of the advantage claimed for very heavy settings. I do not feel prepared to express a strong opinion on that point at present. Our setting is about the average. We have some four sets of saddle tiles &c., and have tiles under the bottom retorts.

Voted: that the thanks of the Association be tendered to Mr; Greenough for the able manner in which he has treated the subject presented by him, and for the clear and accurate exhibit of the results of his experiments by the tables of figures just shown and explained to us.

Mr. Milton Jewett, of the Clinton Gas-Light Co., Mass., having been recommended by the directors for membership, was accordingly duly elected a member of the Association.

The President—The next business is the reading of a paper by Col. Armington, of Brooklyn.

Col. Armington—I think this paper was referred to by the secretary as being a paper on "Statistics." A gentleman of the Board of Directors suggested that it might properly be termed "Mortuary Statistics." I wish to say that this is not a paper from which we may expect to learn anything new, but it is simply a review of what has been done during the past 10 years.

Looking over the files of the American Gas-Light Journal, we find in the number dated Merch 2, 1866, the names of nine different parties who have new schemes for making illuminating gas.

Of all these proposed schemes not *one* of them, as there described, is in use to-day. One there named is in use, but in another form, and so changed, that unless its inventor has closely followed it up through the various changes it has passed, he would hardly know his child. The very flattering promises with which these various schemes were set forth, and the millions which were in them have not been realized; the old and corrupt gas companies which were to have been swept out of existence still linger, and still continue their feeble effort to furnish a cheap and steady light to their consumers, and a fair dividend to their stockholders.

The editor of the Gas-Light Journal, at that time, seemed to have been one of those men who was not easily carried away with the inventions set forth in his paper, and says, "the process for generating gas from coal is most consistent with nature. A proper class of coal supplies the due proportion of carbon and hydrogen, and where such coal can be obtained at a reasonable cost it is, no doubt, the most proper material for the manufacture of gas in large quantities." Whether the present editor had anything to do with the sentiments just read it is impossible for me to know, but notwithstanding there have been in

ventions for furnishing cheap gas made from other materials since the editor wrote the above, yet there does not seem to have been much of a departure on the part of his successor from the sentiments quoted in regard to coal gas. How many of us have had our patience tried by the inventor (?) of various schemes for making cheap gas, and to what straits have we sometimes been driven by those interested in these schemes, to escape their eloquence, and to refrain from taking a little stock in the companies which they were starting, and which were sure to succeed. The editor of the AMERICAN GAS-LIGHT JOURNAL at that time, 1866, seemed to have been aware of the griefs and fancied slights which these inventors had suffered at the hands of the engineers of the large works of the country, and he says; "Many, who have their pet chemes in gas economy, apprehend that engineers of gas works, particularly large ones, are opposed to all new projects as innovations. On the contrary, our experience has led us to know they desire to learn anything which is of real value and merit. But so many fallacious ideas and impracticable propositions are suggested, and tests of them requested, that they have become more reticent, and, unless something really new is proposed it is not deemed worth an analysis, because everything of the past has been fully examined here, as also in Europe, and the results reported." I am led to think that after so much of this editorial as I have quoted had been written, there came to the mind of the editor a suggestion, that perhaps he had been a little hasty and hard in some of his conclusions, and he therefore informs us that he believes a *new era* is dawning upon the gas world; and he further describes it by saying, "that it is something which will interest gas companies, and arouse them from the lethargy which at present exists upon the subject among a large majority of the companies." Now, if that editor had been an engineer of a gas works, that word lethargy would not have been written, but in its place would have appeared an explanation, showing the reason why gas companies have not the right to introduce any change into their mode of manufacture which would endanger the constant supply to their customers, of a steady and uniform light and I think he would have further said: "In view of the many lamentable failures which have already occurred in trying to introduce some new scheme of gas making in already complete establishments, does it not become all prudent managers and all concerned in the manufacture of a good reliable gas, to insist that those having pet schemes which they wish to introduce, should do so at their own expense, and not attempt to force their crude ideas and half digested plans upon the attention of those who are interested in gas companies, but who are not supposed to be posted in the manufacture of an article in which they have only a monied interest, by saying, as many of them do, that, but for the prejudice of you engineers you would try my scheme and adopt it." The issuing of pamphlets, many of them marked private, in which it is claimed that millions can be saved, (dollars is meant, gentlemen, not c. f.,) in the manufacture of gas, by some particular method known only by the inventor and a few of his friends, is another subject which needs as much investigation as the celebrated Keely Motor; and, when examined, is about of as much value to gas engineers as that widely known humbug is to the mechanical engineer, who should place any dependence upon it as a motor. In August, 1866, after having patiently waited for some of the inventors of the new process for making cheap gas, the editor of the AMERICAN GAS-LIGHT JOURNAL says: "We have waited impatiently for a long time past to learn of some important improvement in the manufacture of illuminating gas, but, notwithstanding the representations made to us from various parties that very soon there would be a most complete set of works, ready for public examination and test; we have never as yet had the pleasure of seeing any; there has been good cause for an expectation of *something* of real value, from the statements made to us, and we are much disappointed that the expectation has not been realized." How many times, gentlemen of the N. E. Association, have we looked in the same direction, and for the same promised results, which have never been produced, and, consequently, could not be furnished to us. Our friend, the editor, gives us another opinion in regard to using various articles for gas making, and also as diluents, and says: this proposition is solely for places where but a small quantity of gas is required; in cities where large works are required, we consider the use of any other article than coal simply absurd. Our friend, the editor, having laid down the law with regard to the proper material from which gas should be made, and I think we quite agree with him, although ten years have elapsed since he wrote it, goes on to say: "that there has been proposition after proposition, water-gas, wood-gas, atmospheric-gas, petroleum-gas, combination of zinc, superheated steam, etc., with vagaries innumerable, and out of all these, it is very remarkable that there cannot be some principle established for the action of gas works of certain requisitions, and in certain localities." I have no doubt, gentlemen, that it seems just as remarkable to you, at this date, when so much has been said about the cheap and superior gas that can be made from different articles and in various ways, that it is not done, and that our customers are still supplied with coal gas, and, for aught we can see, so far as any other process now before us is concerned, are likely to be for some time to come.

Following these remarks of the paper of date given, the editor grows somewhat sarcastic, and his language is somewhat ambiguous. He says, in speaking of a convention of gas officers for each state, he thinks it wouuld be highly advantageous, and enlighten those who are ignorant of the science of generating gas, and a practical and economical management of the works. That gas engineers are busy with the problem of making a good, reliable cheap gas, we all know; and the fact that we are now producing more gas from a ton of coal than in former years, and at less price for labor, and that we have also made advances in the proper and economical mode of the treatment by condensation and purification, cannot be denied. That we are still striving to perfect ourselves in the management of the best interests committed to our care, is evidenced by our meeting together and consulting upon the plans, facts and experience, which come to each of us in the daily prosecution of our business, and by which we hope to benefit ourselves, the companies which employ us, the community in which we live, and the consumers who buy our products.

Voted that our thanks be tendered to Col. Armington for the paper just read.

Col. Armington—A few days since I called upon an engineer of one of the New York gas works, who has taken great interest in the subject of equalizing and regulating the pressure of gas in street mains, and he showed me a governor which he had just completed and put into operation, which I examined vary critically, and was much pleased with its construction and mode of working. I have brought some of the cards taken from it (for it is self-registering) which I will now exhibit to you. These cards show the variations of pressure most perfectly; in fact they are the most perfect cards of the kind I ever saw. All that is required to put the governor into operation is to wind up the clock connected with the governor, every 24 hours. The pressure can be given at any hour of the day or night.

If desired, any pressure can be maintained for any length of time required. The governor is entirely automatic, and requires no attention whatever, except the winding of the clock. I advise you all to take the earliest opportunity to inspect it.

Mr. W. W. Greenough—I wish to take this opportunity to invite you all to visit, at your convenience, either the works or the office of the Boston Gas-Light Co., or both. If you will specify any particular time for your visit, we shall be most happy to wait upon you. Arrangements were accordingly made for the visit.

The President—In searching yesterday among my papers I found this newspaper, the Worcester *Evening Gazette*, published December 22, 1870, at the time of the death of Hon. James B. Blake, Mayor of the city of Worcester, Mass., Engineer and Agent of the Worcester Gas-Light Co. The greater portion of this paper is devoted to a short history of the life of William Blake, with a statement of the circumstances of his untimely death, and a full description of the funeral services; also the record of the action of the City Government and the various societies with which he was connected, in respect to his memory. We know if Mr. Blake were living to-day that he would be one of us, and that he would stand in the front rank of our profession, honored by the gas engineers of this and other countries. As this the first record book of our Association is now nearly filled, I would suggest that a page be set apart therein, suitably inscribed to the memory of our deceased friend, and that this newspaper be placed in the archives of the Association.

At the request of Mr. Cabot the secretary read the following extract from the first page of the record:

"Mr. Greenough stated that at an informal meeting of gentlrmen connected with many of the gas companies in the New England States and New York State, *held immediately after the funeral of Hon. Jas. B. Blake, late agent of the Worcester Gas Light Co.*, at the Bay State House, in the city of Worcester, a commtttee was appointed to draft a preamble and articles of agreement for an Association of Gas Engineers, with authority to call a meeting to act upon the adoption of the same, and to organize an association."

The suggestion of the President in relation to the record and to the filing of the paper presented by him as a special tribute to the memory of Mr. Blake, was unanimously adopted.

The association then took a recess until half past three o'clock in the afternoon.

GEORGE B. NEAL, Sec.

The Manufacture of Coal Illuminating Gas.

By ALFRED P. TRAUTWEIN, M. E.

A Graduating Thesis at the Stevens Institute of Technology, Hoboken, N. J.

Continued from page 127.

We have not yet touched upon the subject of the distribution of illuminating gas and to this, therefore, it isnow proposed to devote the remainder of this paper. Any attempt, however, to examine the distributory plant as thoroughly as might be considered advisable would obviously extend this paper to an inordinate length; we will consequently confine ourselves to what may be regarded as absolutely essential, and our remarks will necessarily be both brief and general, and may possibly be made in a rather disconnected manner.

A proper system of distribution is an element of most vital importance in the commercial success of any gas works; to increase the efficiency of his distributory plant is the constant aim of every manager, and no department of his labors requires more constant and faithful care and supervision.

The first topic, then, which naturally would engage our attention is that extensive system of mains, connections, etc., by means of which the distribution is effected: in short, all that is comprised under the general head of

STREET MAINS.

The mains employed in the distribution of gas, like those for water, are generally of cast iron; in some instances a peculiar form of wrought iron pipe has been used for both of these purposes; not only, however, was the first cost somewhat greater, but it was found that it is not nearly as durable as the cast iron main, in which the hard scale has been found to be an excellent preventive of rust.

In calling for proposals for his mains the gas engineer generally prescribes substantially the same conditions and precautions to be observed in their manufacture, which it has been found necessary to stipulate in the case of water meins; they do not, however, require to be quite as stringent in somere pects on account of the lower pressures to which gas mains

are subjected. For our purposes it will suffice to say that the pipes should be made of a good quality of gray iron, such as may readily be chipped, drilled, and tapped in making the connection with the service-pipes; all above four or five inches in diameter should be cast vertically, with the bell or socket end down, in order to prevent blow holes and to secure strength; the body of the pipe should be uniformly thick, the thickness varying between $\frac{3}{8}$ inch and $\frac{9}{4}$ inch according to the size of the pipe; they are generally cast in lengths of either nine or twelve feet, occasionally a trifle longer.

In laying the mains very much the same considerations, as in the case of water mains, should influence the engineer, and it is of vital importance that this be performed in the best possible manner. A few remarks, therefore, upon the proper locality for the gas street mains will be in place. This is determined largely by the nature of soil; it is hardly necessary to state that a rocky soil should be avoided, if possible, as a matter of economy, while very soft or marshy soils are open to the objection that the line of pipe may settle unevenly, and by the undue strain to which portions of it are thereby subjected, may cause the joints to yield and leak, and in extreme cases may result in the fracture of the pipe itself; to prevent this it is necessary in such soil to go to the expense of preparing a proper foundation for the mains.

The nature of the traffic in the street is another element which must be considered; the continual vibrations due to passing vehicles are very liable to have an injurious influence upon the joints, and the mains should therefore be located as near the curb-line as possible, this course having the additional advantage that the mains may be uncovered without seriously impeding the traffic.

The pipes should be laid at some depth below the surface of the street, in order that they may be beyond the reach of frost, which in our climate has frequently been found to penetrate the soil to a depth of four or five feet; this precaution is necessary in order to prevent the alternate and continual expansion and contraction due to changes of temperature, and having a tendency to work the joints loose; it must also be observed more particularly because of the fact that the gas must be protected from the influence of low temperatures, whose injurious effect upon the quality of the gas is plainly evident.

There are still other disturbing elements which must be kept in view in laying down a system of gas mains; it is very essential, for example, that the neighborhood of sewers, water mains, etc., be avoided as far as possible: sections of these frequently require repair and consequently necessitate a disturbance of the surrounding soil.

At times, however, the engineer has little or no choice in the selection of the route for his mains, being confined within the distance between the two curb-lines of the street; under such circumstances the expense of laying the mains might be great, and the mains themselves might be subjected to various disturbing influences tending to increase the leakage at the joints; it then becomes his duty to reduce this loss, to some extent unavoidable, by devoting particular care upon the joints themselves. The signal importance of this matter caused it to receive a vast amount of attention; it is not surprising then, that a very large number of methods for jointing the mains have been devised; it is, of course, entirely out of the question to examine even the more meritorious of these, and we will confine ourselves to a general classification. Almost universally the joint between the spigot end of one, and the socket end of the next pipe is made by means of lead; the method does not differ from that resorted to in the case of water-mains, and is as follows: A gasket of one or two inches of untarred rope-yarn is first rammed in tightly; above this is poured melted lead, confined in place by a mould of clay around the joint, all finally being well caulked. This form of joint has been modified by using cement instead of lead, and it is claimed that such a joint is not only made more quickly but is infinitely cheaper than the lead joint.

Some engineers strongly advocate the use of some form of turned and bored or flanged joints, there being no difficulty in the first place, in making them gas tight; they are, however, very expensive, and are open to this very serious objection; that such a system of mains is too rigid and inelastic, and is not at all adapted to withstand the many disturbing influences already pointed out, to which it is invariably subjected. The ordinary lead joint, when well made, is practically gas tight, is much less expensive, and moreover, is quite elastic. So well, indeed, is this necessity recognized of providing a certain degree of flexibility in the system, that the attention of inventors appears to have been solely in this direction: thus several attempts were made to so modify the ordinary socket and spigot lead joint as to make it in a degree universal. The ordinary lead joint described above is, however, quite satisfactory for all ordinary purposes, and, indeed, is in more common use than any other; there are instances, however, in which one of the several forms of flexible joints might find a good application, and in laying pipes under water, for instance, it has been used with advantage.

Great attention should be devoted to the grading of the street mains, etc., and the accumulation of products of condensation should be prevented by providing a series of drip-boxes at proper intervals. It is assumed, of course, that there was no want of proper supervision during the work of laying the mains: and, finally, before refilling the trenches the entire system must be carefully tested, in sections, for the purpose of detecting any imperfect joints.

SIZE OF STREET MAINS.

The size of the mains is determined by the following elements: In the first place, by the quantity of gas to be supplied; secondly, by the distance to which it must be carried; thirdly, by the pressure which it is proposed to carry, and finally, by the density of the gas. We will make no attempt to supply the data requisite for our special case, since too many local conditions would require to be taken into consideration; the consumption would probably vary very irregularly at different points in this district, and this renders the problem still more complex. The following well-accepted formula, however, might prove of value in determining the size of mains:

$$D = .063 \sqrt[5]{\frac{Q^2GL}{H}} \text{ in which}$$

Q is the quantity of gas required in cubic feet per hour.

L, the length of the main in yards,

D, the diameter in inches,

G, the specific gravity of the gas, and

H, the pressure in inches of water.

It must be borne in mind, however, that the greater part of the consumption occurs during a period of not more usually than six hours: the capacity of the pipes, therefore, must be sufficient to furnish the daily supply in less than twenty-four hours. There are still other reasons why care should be taken to make the mains of abundant size; a due regard should be had for the future growth of the city and, therefore, of the consumption, in determining upon the size of the mains, more particularly since the cost of laying large mains is not materially greater than that of small mains, the only difference being the greater first cost of the former. A second argument in favor of large mains lies in the fact that the proper gas supply may be effected under lighter pressures. It is quite sufficient when the gas reaches the most distant point of consumption at a pressure of .8" to 1.0" of water; of this .2" is consumed by the mechanism of the meter, .2" by the friction in the service-pipe, leaving for the effective pressure at the burners .4" to .6", which has been found quite abundant for all ordinary purposes, and best adapted for thorough combustion. Any excess in the pressure is not only superfluous, but is absolutely objectionable, since it materially increases the amount of

LEAKAGE,

already so unavoidably great. In the ordinary acceptation of the term, leakage is the difference between the amount of gas made as per station meter, and which is actually sold or otherwise accounted for; it thus includes all losses due to leakage proper in the mains, shrinkage in the volume caused by changes of temperature and by condensation as well as all losses by purloyance; finally, defective registration at the consumers' meters is a further source of loss, while in the majority of cases the public lights, which are provided with meters only in very exceptional cases, consume a larger quantity of gas than they are entitled to by the contracts. Leakage, of course, should not include the gas used on the premises and which, in every well regulated works, is registered carefully. The gas which is thus unaccounted for, constitutes frequently a very appreciable percentage of the actual quantity manufactured; being a matter of such vital importance, the subject of leakage receive much attention, and the proceedings of the several associations of gas managers abound with much valuable material.

Thus, for example, the average leakage of sixty-eight works as reported to the West of Scotland Association of Gas Managers was 15.8 per cent.; on good authority the leakage of twenty-four English works, several of which in London, averaged about 9.5 per cent. From an inquiry as to the leakage of a number of American gas works, instituted by Mr. James R. Smedberg several years ago, it appears that from 6 per cent. to 12 per cent. are common figures, and according to recent authority, the leakage of thirteen works in the New England States averaged a little over 12 per cent. The Philadelphia City Gas Trust, finally, reports the leakage for the last eleven years (1865–'75) as averaging about 13.6 per cent.; it must be added, however, that this includes the amount used at the works and office of the Trust.

As might naturally be expected, the leakage varies between very wide limits, depending, as it does, upon such a multiplicity of conditions; thus numerous instances have been noted in which it has reached, or even exceded, 30 per cent. of the gas made at the works, while others again, have been recorded with a leakage account of 3 or 4 per cent., and in a few exceptional cases with even less than this, thereby certainly reflecting great credit upon the manager. It is probable, however, that a loss of from 10 per cent. to 15 per cent. would represent a fair average.

[To be concluded in our next.]

Weights and Measures.

Mr. H. W. Chisholm, the Warden of the Standards, has just issued his tenth annual report on the proceedings and business of the Standard Weights and Measures Department of the Board of Trade. Thus, it is provided, by statutes passed in 1859 and 1860, that throughout Great Britain and Ireland, no copies of the standard weights shall be legal unless reverified in the Warden's Department within five years; and no copies of the standard measures unless so reverified within ten years; but a proviso was added authorizing copies of the county standards to be locally reverified within the same periods, by comparison with one of the county sets which shall have been duly reverified in the Standards Department. It appears that, although the law requires gas-measuring standards to be verified in the department, there is no provision for their reverification.

The number of local standards rejected during the year on account of bad workmanship, or as requiring readjustment, was 325 in respect to weights, and 76 in respect to measures—or a total of 401; being 14 per cent. on the total number (2780) verified and reverified. From 1869 to 1873, both inclusive, the number rejected range from 11 to 20 per cent., whereas in 1874 the number was 13 per cent., and in 1875 only 9 per cent., now followed by a rise to 14 per cent.

* * * * * * * * *

A series of standard weights and measures has been verified for the Government of Siam during the past year. Mr. Chisholm says it should be noticed that a

m the standard temperature for weight and meas-es, is 85° Fah. The Siamese unit of length is the wa," consisting of 80 English inches, defined by es upon a solid bar of standard silver. The Siam-e unit of weight is the "chang" called by foreign-s the "Siamese catty," its legal weight being equal 2·675 pounds avoirdupois. This standard weight constructed of platinum iridium. Altogether eight ndards were manufactured for the Siamese Gov-rnment, and submitted to Mr. Chisholm's depart-ent for verification. The standards thus made were und to be correct within a fraction which seemed ry small. Nevertheless the error was sufficiently rge too exceed the limits prescribed by the Stand-ds Department. Consequently the stamp of the partment was not affixed to the standards, but offic l certificates of verification were given, showing the sult of the examination or comparison. The stand-ds were engraved with the royal seal of Siam, and ith a shield for an inscription to be engraved upon em on their arrival at Siam. We should fear that further process of engraving would again disturb e fractions of accuracy in respect to the weights, ough Siamese science may rest satisfied with the sult.

During the past year a complete set of Russian andard weights having been constructed in London r the Government of the Czar, a request was made Mr. Chisholm by General Gloukhoff, the head of e Standards Departments at St. Petersburg, to com-are the several units of this complete set, and to give eir values in terms of our Imperial standard pound. he standard weights have undergone a scientific re ision in Russia, and it appears that there is a slight eparture from the customary figures. The Russian ound was stated a few years ago to consist of 6318·5 rains. At another time it was 6316·81 grains. It is ow given as 6319·73146 grains, or 40951196 metric rammes. The standards examined by Mr Chisholm id not differ materially from tha normal values they ere intended to represent, and they were according y certified in the usual official form to General Glouk-hoff.

The time came round during the past year for re-erifying, under the Standards Act, the standard eight of 62·321 pounds, being the legalized weight f a cubic foot of water, together with its official opies; and also for reverifying the standard cubic ottle, representing the measure of a cubic foot of istilled water weighed in air against the standard 2·321 pound weight; as well as the gas-measuring tandards of 1 cubic foot, 5 cubic feet, and 10 cubic eet, the contents of which are based upon the stand-rd cubic-foot bottle. The standard cubic-foot weight, with its three official copies, was last reverified in 870. One of the official copies was presented to the French Government in 1871. Consequently only two official copies in addition to the standard remained to e reverified last year. These are made of hard gun-metal, and are cylindrical in form with a knob. They have now been reverified by comparison with the same bullion standards that were used for their original re-verification in 1859, and for their reverifications in 1868 and 1870. These comparisons have been checked by further comparisons with the avoirdupois reference standards. Compared with the results obtained in 1870, in which year the weights were readjusted, there now appears an increased weight in the standard to the extent of 5010 grains. The two copies have in-creased in weight by 4241 grains and 2538 grains re-spectively. This augmentation of weight is consid-ered due to the oxidation of the comparatively large surfaces which are exposed. These weights do not, however, require to be now readjusted, as their small ascertained errors can be allowed for in comparisons made with them. It is curious thrt the standard weight showed the least error after the readjustment in 1870, but now shows the greatest. Still the great-est discrepancy is so minute as to amount to less than one part in 80,000, the present error of the standard weight being 5404 grains out of 92,321 lb. The cubic-foot bottle has increased 4·12 grains, or 0·056 parts of a cubic inch in capacity since 1869. The present error, in excess, is 174·4 grains, or 0·090 part of a cubic inch, being about one part in 2500. The three standard gas-holders were readjusted and put into complete working order in 1875. Consequently, their errors are but slight, though the cubic foot gas-holder is rather less correct than it was in 1869. The present ascertained errors, in parts of a cubic foot, are a de-ficiency of 0·0025 in the cubic foot gas-holder, an ex-cess of 0·0030 in the 5 cubic feet holder, and an excess of 0·0110 in the 10-feet holder. The errors allowed to the local gas measuring standards are appreciably greater than the foregoing, so that none of the latter will be rejected through errors in the imperial stand-ards.

It is a singular omission in the Sale of Gas Act that it makes no provision for the periodical reverification of either the official gas-measuring standards, or the copies deposited with the three metropolitan cities, nor indeed, of the many copies verified for the use of the local inspectors of gas meters. On receiving a suggestion from Mr. Chisholm, the chief magistrates of London, Edinburgh and Dublin at once consented that the gas-measuring standards in their custody should be put into complete order, and the cost paid out of their corporate funds, The process had not been completed at the date of the present report, so that further reference to the subject is postponed. The propricty of this reverification is shown by the fact that the official gas-measuring standards in the keeping of Mr. Chisholm's department were found to require taking to pieces and setting to rights, so as to rid them of the injurious efiects of oxidation.

The question of a standard photometer for measur-ing the illuminating power of coal gas comes under discussion in the present report, and would seem to be as important as the institution of a standard o-quantity. The instruments now in use for measur ing the lighting power of gas include the 100-inch photometer invented by Mr. G. F. Evans; the 60-inch photometer designed in 1863 by Dr. Letheby, and since adopted by the metropolitan gas referees, as well as by the authorities in Canada; Mr. G. Lowe's jet photometer, said to be used as a standard in Italy, and the illuminating power meter introduced by Mr. Sugg. The Evans photometer requires no dark closed room for its operations, and on that account is much used in hot countries. It is also much used in the United Kingdom, particularly by companies sup-plying gas of high illuminating power. Concerning Sugg's illuminating power meter, it is claimed that the lighting quality of the gas can be determined in one minute from the quantity of gas (measured by an experimental meter which is a portion of the appa-tus) found requisite to maintain a flame of gas 3 in-ches high for 60 seconds. In Lowe's jet photometer, also, the lighting power of the gas is deduced from the quantity required under specified conditions to maintain a flame 3 inches high. The photometers of Evans and Letheby are based on Bunsen's method, a disc of paper, partially greased, being interposed be-tween the standard light and the gas flame. The disc is moved to or from one or the other of these lights, until the greased spots are, as near as may be, imper-ceptible to the eye. It is then tolerably certain that the transmitted light from the one flame is equal to the reflected light from the other. The flame nearest to the disc is therefore the weakest, and the relative distances afford a measure of the power. The method in some degree resembles Count Rumford's equalisa-tion of shadows.

Mr. Chisholm observes that "the time has not yet arrived when any photometer hitherto constructed can be relied upon for giving constant accurate re-sults." The difficulty consists in obtaining a trust worthy unit—that is to say, a standard light certain to afford the same degree of illumination so long as the known conditions are unaltered. Hitherto no better standard than the sperm candle has been found. Sperm candles burn at rates varying from about 115 to 126 grains per hour, and the gas examiner has to make allowance for this varying rate. Although a correction is thus applied according to a specified rule, it is doubtful whether the same quantity of sperm always yields the same light, as there is reason to be-lieve that an effect is produced by the quality of the cotton wicks and the method of their plaiting. Mr. Chisholm is informed that a sperm candle recently brought from Russia and tested here against a regula-tion sperm candle was found to be ten per cent. bet-ter in quality, and to have proportionately increased illuminating power.

Attempts have been made to employ Mr. Crookes' radiometer as a photometrical instrument. But it is doubtful whether the action of the radiometer is not rather due to heat than to light. Mr. Chisholm says it is of importance to add that, in the event of any standard photometer being adopted, it is absolutely necessary that authorative regulations for a uniform mode of using it should be prescribed. This gentle-man further observes that the question of legalising a standard 60-inch Letheby photometer in this country, as it has been already legalised in Canada, is well wor-thy of consideration.

An additional set of standard decimal grain weights has been constructed during the year, to be used spe-cially in trials of the pyx. These weights are made of hard brass, and it is proposed to take every precau-tion in their use, by strictly following the official reg-ulation never to touch standard weights with the hand, but to lift them either with a proper fork, or with a wash-leather, carefully wiping them with a wash-leather after use.

A somewhat notable event of the year has been the laying down at Trafalgar Square of several standards of length embedded in a solid platform of granite. All the details of this operation are given in the appendix to the present report. The platform is situated at the foot of the north wall of the square, and the en-tire cost has been about £450. These mural stand-ards are now available for public use, like those erec-ted outside the wall of the Royal Observatory at Green-wich, only the Trafalgar Square standards are on a much larger scale, the platform being nearly 260 feet long. The Standards Commission, in one of their re-ports, recommended that mural standards of length should be securely fixed for public use in all populous towns, the expenses connected with them to be de-frayed out of the local funds. The Warden of the Standards has accordingly sent a circular letter to the local authorities urging the expediency of their carry-ing this recommendation into effect; at the same time offering them such information as in his judgment would facilitate their course of action.

Various other matters are referred to in the little volume before us, and it is evident that the depart-ment of the Warden of the Standards is not only ex-tremely useful, but of increasing importance. It is impossible not to admire the high degree of scientific skill displayed in the various operations, as well as the zeal with which the duties of the department are discharged.—*Iron.*

Periodicity of Severe Winters.—A memoir by Renan, the distinguished French meteorologist, upon the periodicity of severe winters, although published many years ago, has recently been quoted in defence of the opinion that such periodicity actually exists. According to Renan, rigorous winters return about every forty-one years. They are arranged in groups generally composed of a central winter, and four or five others disposed on either side of it, within a space of twenty years. Mixed with these years are others also of unusual warmth, in such a manner that the mean cold of the season is not sensibly altered. The period of forty-one years seems to be that which corresponds to the maxima of the solar spots at the same season of the year. A central cold winter ar-rives eighteen months after the maximum of spots has coincided with the warmest season of the year.

The severe winters seem to alternate between the northen and southern hemispheres of the earth.—*Ibid.*

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MONDAY, APRIL 16, 1877.

Correspondence

[Correspondents, in all cases, should sign their communications with their names and address in full—not for publication, unless desired, but as a guarantee of good faith.—ED.

Temperature of Retorts.

111 Broadway N. Y., March 17th, 1877.

Mr. Editor: I think Mr. M. S. Greenough's experiments on the temperature of retorts, as given in your last issue of the JOURNAL, ought to convince the gas fraternity that the temperature of the retorts is reduced, by the fresh charge of coal, to a point far below that required to convert all the vapors into a fixed gas.

Before the 208 pound charge was placed in the retort, the temperature of the retort was 2274° F., and one hour after the charge was put in, the temperature of the retort went down to 1271° F., or to a very dull red heat; and, I think, if the test had been made in 30 minutes after the charge was put in, that Mr. Greenough whould have found the temperature much lower than that.

Dr. Gesner says that, "In order to obtain the greatest amount of commercial oils, the heat of the distilling vessel should not exceed 800° F." Consequently, as our present method of charging our retorts brings the temperature down pretty near to that point, I am sure that a large portion of the vapor, which is generated during the first hour of the charge, is all converted into a tarry oil, during its passage through the hydraulic main, condenser, scrubber, purifiers, meter, holder, and street mains.

Before the 200 pound charge was placed in the retort, the temperature of the retort was about 2239° F,, and one hour after the charge wss put in, the temperature of the retort went down to 1400° F. or 839 degrees.

By adding 8 lbs. of coal to the next charge, the temperature of the retort fell from 2274° F., down to 1271° F., or 1003 degrees.

Now, if an extra 8 lbs. of coal can make such a difference in the temperature, what will a 250 or 300 pound charge make?

According to the preceding statements, I am under the impression that a 250 pound charge will reduce the temperature below 800° F., or to that degree required for making commercial oil from coal.

And, if the temperature of the retort is reduced to such a low point with the *dry* Penn coal, as used in Mr. Greenough's experiments, I think a 275 pound charge of *wet* coal will reduce the temperature to a point that will be suitable for roasting potatoes.

I hope Mr. Greenough or some other engineer, will make some more of these experiments, and give us the *very lowest* temperature which the retorts go down to during the four hours. This point, I think, will be arrived at in about 30 minutes after the charge is placed in the retort.

They should also put in 250 and 300 pound charges, and test them when the temperature of the retort is down at the very lowest point, for, I think, the results will rather startle some of the gas fraternity, and also convince them that the present retort system is radically wrong.

It would also be advisable to turn all the gas or vapor made during the first hour of a charge, directly into a small gas holder placed as near to the retort as possible, and keep the gas hot till cut off from the retort.

At the end of the first hour the gas should then be measured in the holder while hot, and the temperature of the gas and air should be taken at the same time. After this, the gas should be measured and temperature taken every ½ hour till the gas has cooled down. The same operation may be made on the said gas in holder once or twice a day for one week.

The gas made between the first and second, and between the second and third hours, should be also tested in the same manner.

When we obtain the results from these experiments, we shall then be able to calculate the loss sustained through charging retorts, at long intervals, with heavy loads of coal.

Wm. Farmer.

Cotton Seed for Gas Making.

SHERMAN, TEXAS, Nov. 7th, 1877.

Mr. Editor: * * * * If possible, please let me know the effect of using Cotton Seed with coal in clay retorts.

Does it prevent a deposit of naphthaline in the pipes?

Yours truly,

J. S. W.

[In reply to the above we submit the following from one who has had large experience in the use of Cotton Seed, and who has kindly furnished the valuable information contained in his letter below. ED.]

St. Louis, Mo., March 27th, 1877.

Mr. Editor: Yours, asking if the carbonization of cotton seed with coal will prevent a deposit of naphthaline in pipes, is received.

In answer I can only state that I have been using cotton seed and coal, in equal quantities by weight, at San Antonia, Texas, Gas Works, for the past two years, and that there is no indication of naphthaline in any of our pipes. At the time I rebuilt the works (1873), I found four or five pieces of naphthaline in the old station meter, each about the size of a hen's egg. The meter had not been in use for five years. Rosin and Texas lignite coal had been used previous to my rebuilding the works.

I charge cotton seed and coal in clay retorts, alternately, as the cotton seed does not carbonize the retorts sufficiently to prevent leakage. The yield of gas per lb. of seed ranges from 4¾ to 5¼, according to age of seed. Old seed producing more gas and of a better quality. In quality, cotton seed gas ranges from 12 to 14 candles. After carbonization, the seed remains in the same shape and size, but harder than previous to carbonization, and of no value for fuel.

We use a sheet iron trough charger that will hold 150 lbs. Our retorts are 12" × 20" × 9'. The charges range from 100 to 150 lbs. to each retort. We take all of the gas from 150 lbs. in one hour, with same heat as would require 4½ hours to carbonize a charge of 200 lbs. coal. The charge after carbonization is reduced in bulk about one half. This is owing to the fact that the cotton, which was left upon the seed, had been burned off. The seed costs us at the works from $6 to $7 per ton of 2000 lbs. Indian Nation coal costs $21 per ton of 2000 lbs., and yields about same amount of gas and coke as Pittsburgh coal, and of about same quality. This coal is mined near the Red River, on Missouri Kansas and Texas Railway. If there is any further information I can furnish you in regard to cotton seed gas, I will be pleased to serve you.

Yours Respectfully,

Sylvester Watts.

Arrangement for Cleaning Test Tubes, &c.

110 LEONARD ST., N. Y., April 5, 1877.

Mr. Editor: I have found a modification of the ordinary wash bottle of great convenience in washing off that portion of precipitates which often clings so obstinately to the sides of test tubes, beakers, etc. The modification consists simply in bending up the jet end of the tube at about one and a half inches from the extremity. By this means a vertical jet can be directed with precision into an inverted test tube or beaker.

I have never seen this idea in any book or catalogue, and believe it to be original.

Yours respectfully,

E. H. JOHNSON.

Gas-Light Intelligence.

Canada.

THE LATE HENRY THOMAS.—By the lamented death of Mr. Henry Thomas, Montreal losses one of her most prominent and most worthy citizens. Born in England, Mr. Thomas came to this country at an early age, and for many years his name has been identified with the commerce of the country. As a leading wholesale merchant, as an Alderman, and as the President of the New City Gas Company, he was well known to every one. In municipal and commercial affairs he was distinguished for his integrity and wisdom, while in private life he was invariably kindly, courteous, and unassuming. A thorough gentleman and a man whose word and bond were synonymous, there is no one who knew him—and his acquaintances were many—who does not feel his loss as that of a personal frisnd.—*Montreal Herald.*

On the Existence of Solid Particles of Carbon in Luminous Flames.

Heumann, in his fourth paper on the theory of luminous flames, considers at length the question of the nature of the light-emitting material in luminous hydrocarbon flames, and concludes that it is really solid incandescent particles of carbon. The proofs he offers are: 1st, the increased luminosity which chlorine gives to weakly luminous or non-luminous flames, due to its well-known property of separating the carbon as such. 2d, a rod held in a flame is smoked only on the lower side, the side opposed to the gas stream; were the carbon there as vapor, as Frankland assumes, it would be condensed by a cooling action and so all around the rod. 3d, a body held in flame is smoked even when it is in a state of ignition; this, therefore, cannot be condensation of a vapor. 4th, these particles can be actually seen in the flame when it is made to strike against a second flame or an

nited surface, these particles aggregating together to form visable masses. 5th, the luminous portion of a flame is not very transparent, no more so than the layer of smoke of the same thickness which rises above a flame fed with turpentine. And 6th, flames which unquestionably owe their luminosity to the presence of solid particles give a shadow with sunlight, precisely as do hydrocarbon flames; while luminous flames composed of gnited gases and vapors only, give no such shadow in sunlight.—*Liebig's Annalen.*

Gas Stocks.

Quotations by W. B. Scott & Co., Bankers,
24 Pine Street, New York City.
April 16, 1877.
☞ All communications will receive particular attention

	Capital.	Par.	Bid.	Asked.
Gas. Co.'s of N. Y. City.				
Harlem	$1,850,000	50	105	110
Manhattan	4,000,000	50	215	220
Metropolitan	2,500,000	100	140	145
" Scrip	$1,000,000	...	100	103
" Bonds	500,000	1000	100	103
Mutual	5,000,000	100	98	—
" Bonds, gold.	900,000	1000	105	—
Municipal	1,000,000	100	70	80
New York	4,000,000	100	131	132½
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	175	180
Citizens	1,200,000	20	95	100
" Scrip	320,000	1000	95	97½
Peoples	',000,000	10	40	45
" Bonds	$ 325,000	...	--	95
" Scrip	300,000	...	85	—
Metropolitan	1,000,000	100	76	80
Nassau	1,000,000	25	80	85
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	130	135
" Scrip		...	98	100
Out of Town Gas Companies.				
Central, Westchester	466,000	50	90	95
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	55	—
" Bonds	200,000	1000	—	90
Baltimore, Md	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	98	100
" " Bds.	124,000	—	—	--
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	—
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	180	184
Hempstead, L	25,000	100	...	—
Jersey City	386,000	20	160	—
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown, Maine	400,000	100	50	85
Lima, Ohio	60,000	100	—	...
Bonds	30,000		90	
Laclede, St Louis Mo	1,200,000	100	100	110
Peoples, Jersey City		...	120	125
Peoples of Albany	650,000	100	—	20
" Bonds	350,000	1000	--	—
Peoples of Baltimore		25	76	—
" Bonds			106	—
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Richmond Co., S. I.	300,000	...	97	100
Woonsocket, R. I	150,000	100	100	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	112½	
San Francisco Gas-Co., S. Fr'isco Cal.			111	112
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Suburban, W'stch'str	390,000	50	—	100
Saugerties, N. Y	15,000	100	110	115
Troy, Citizens	600,000	100	—	60
Toledo, Ohio			95	97½

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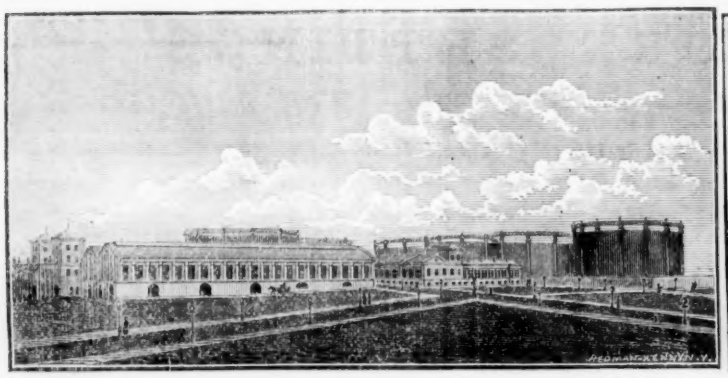

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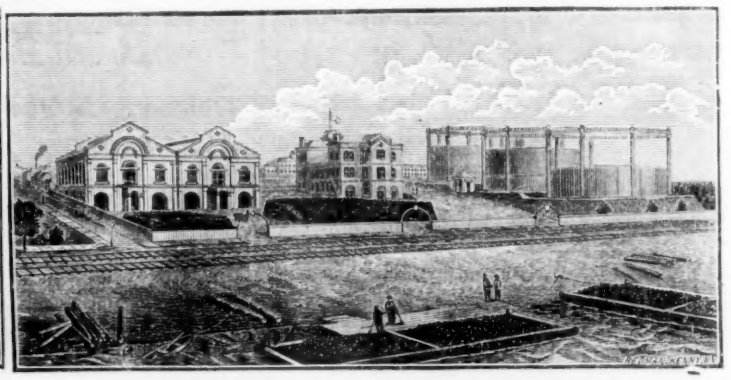

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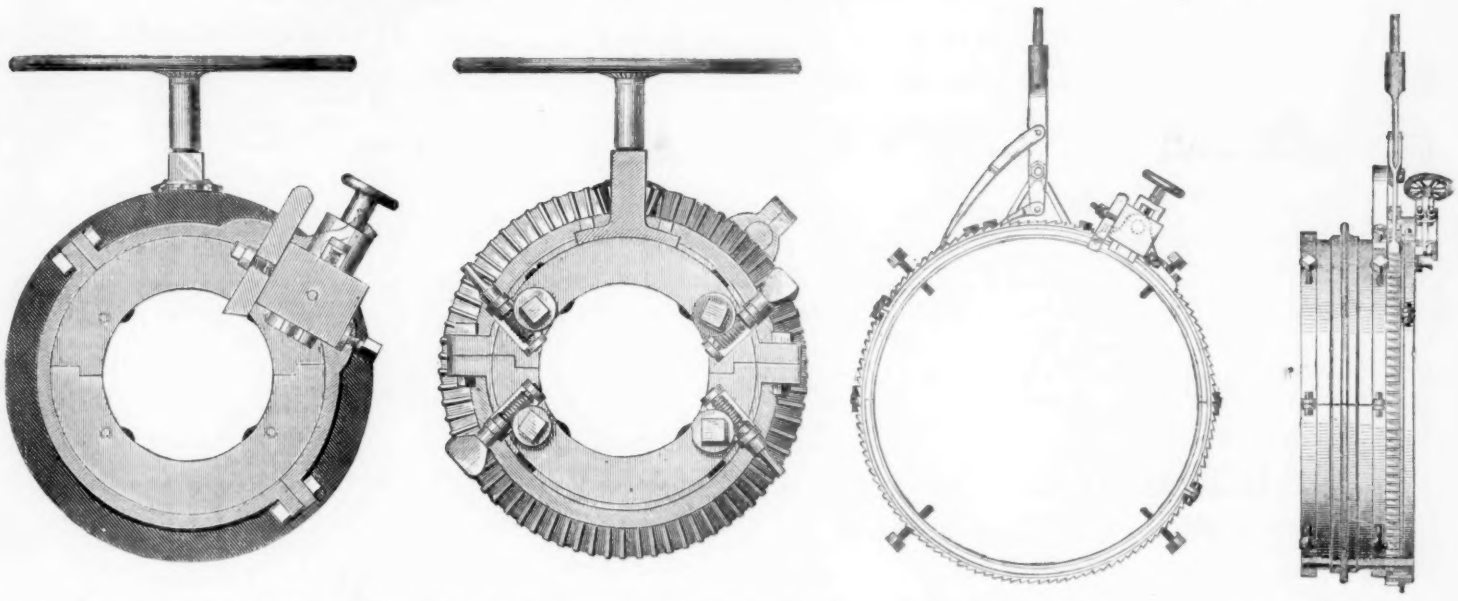

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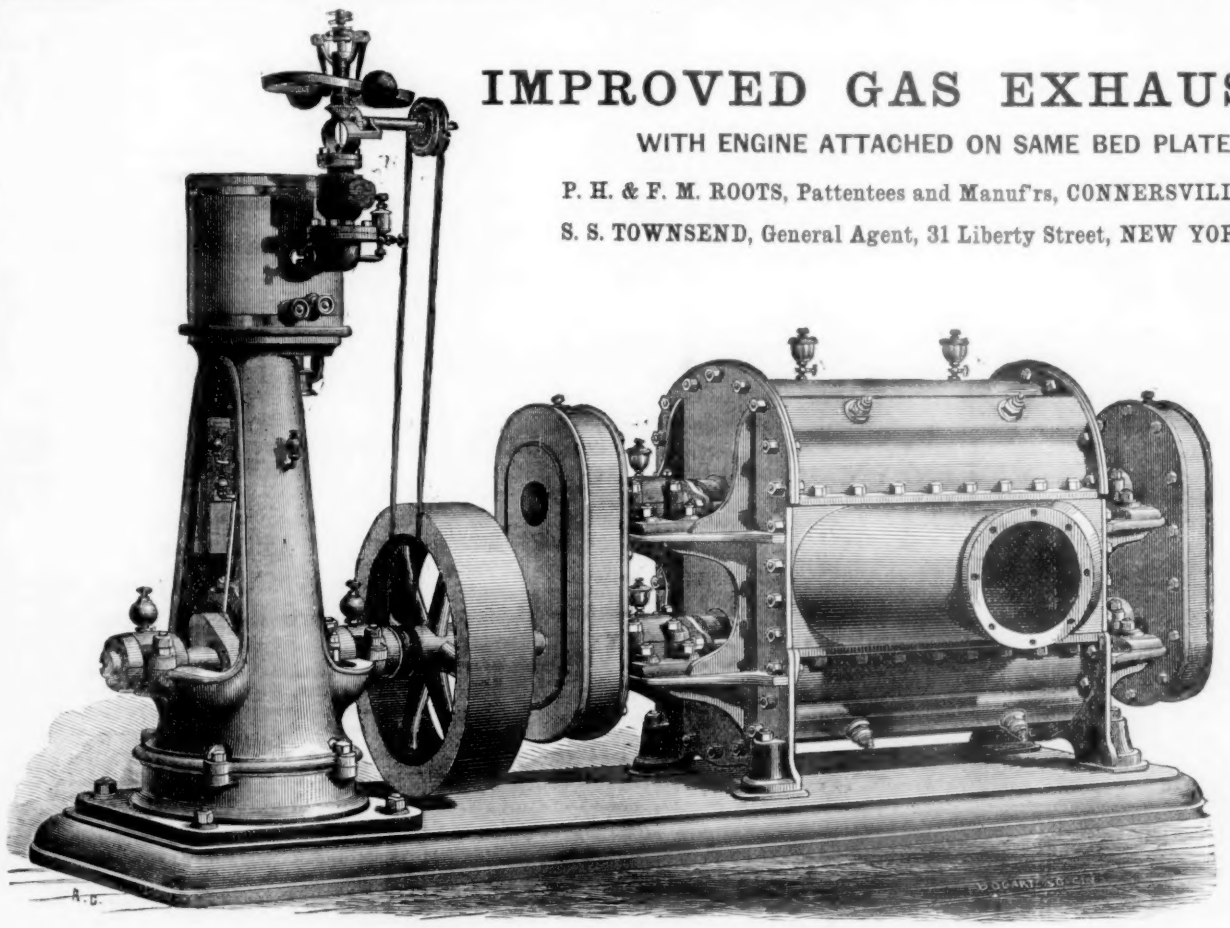

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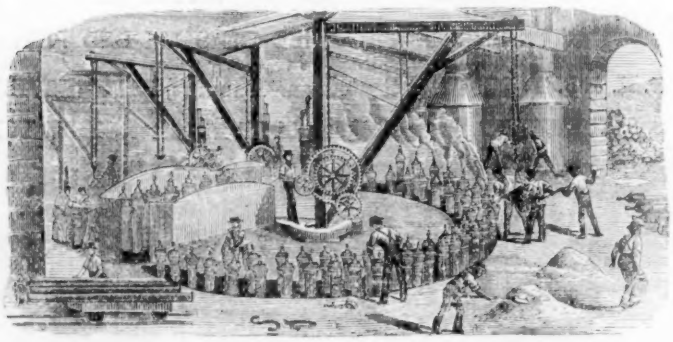

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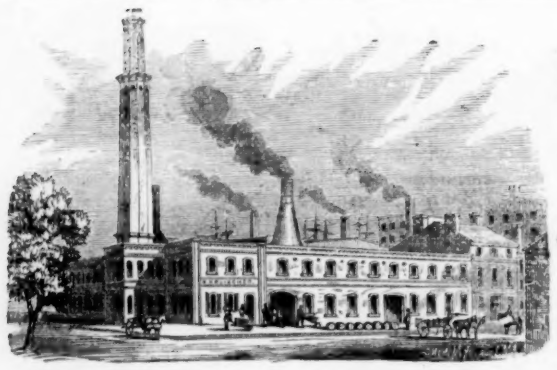

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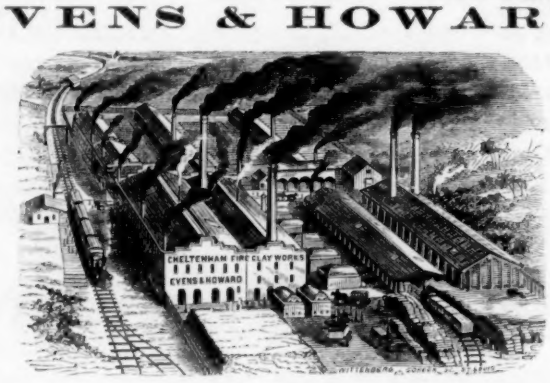

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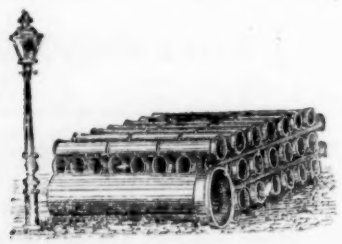

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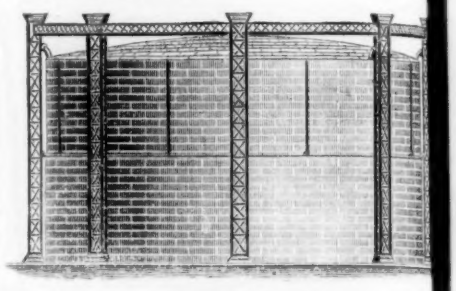

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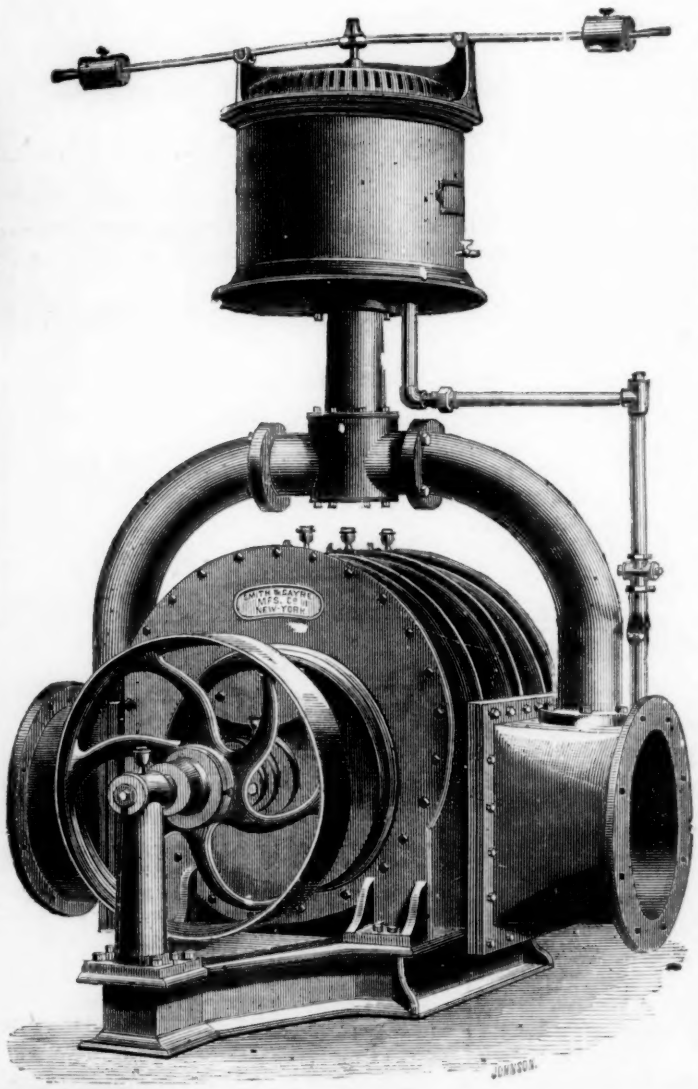

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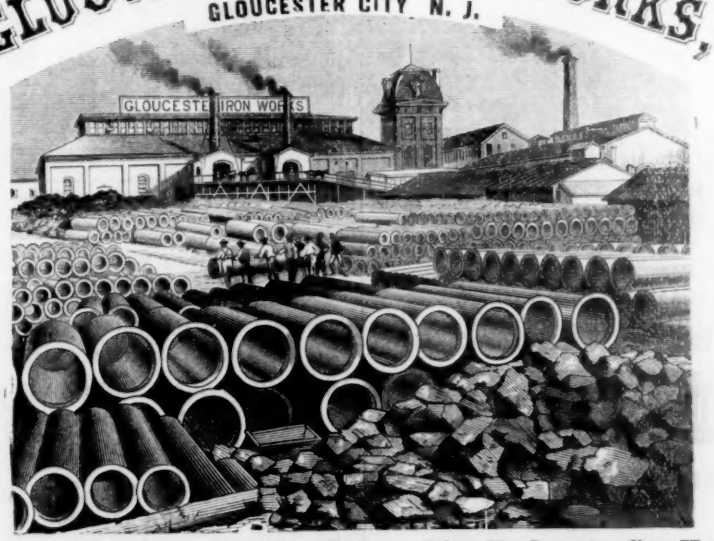

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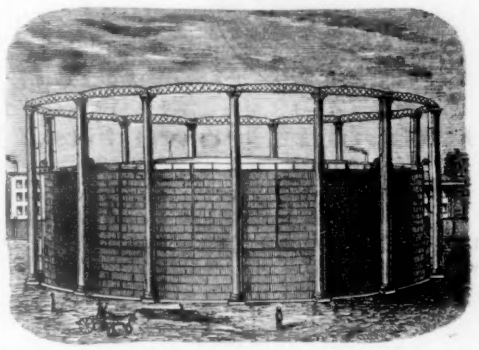

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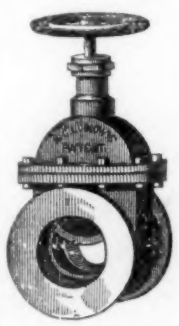

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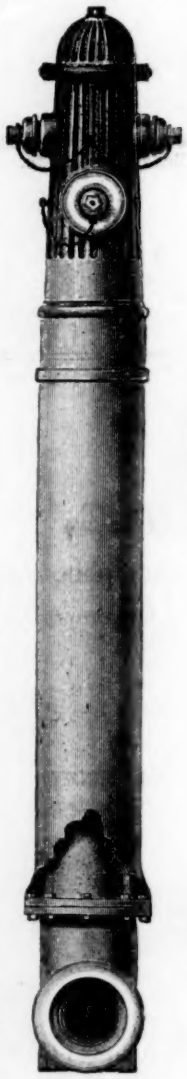

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MANUFACTURERS OF

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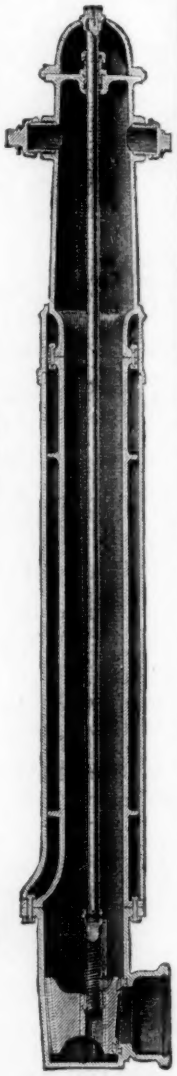
VALVES

AND

FIRE HYDRANTS,

With BABBITT METAL SEATS.



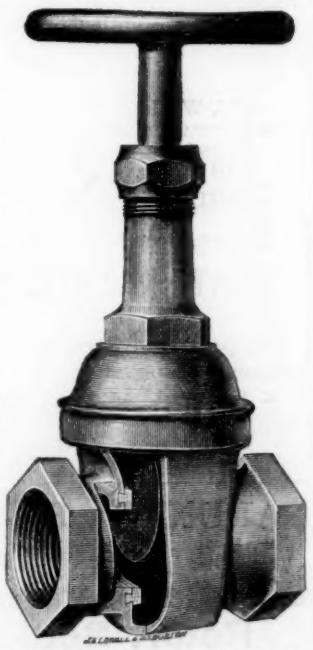
CHAPMAN GAS VALVES

Have been in use since 1869, and are pronounced by all who have used them to be

SUPERIOR TO ALL OTHERS FOR GAS PURPOSES.

They afford a direct passage the full size of the pipe. The seats are made of an alloy similar to BABBITT metal, specially prepared for the purpose, and superior to all other metals used for the seats of Gas Valves, as it does not corrode.

There is NO LIABILITY OF COHESION between the Gate and Seat, and the Valves can be relied upon to SHUT TIGHTLY and OPEN EASILY at all times — an important desideratum when used for street mains, in cases of fire.



ALL VALVES GUARANTEED.

We refer to the following named Gas-Light Companies among the many that have used these Valves:

Boston Gas-Light Company,	Mass.
South Boston Gas-Light Company,	"
East Boston Gas-Light Company,	"
Charlestown Gas-Light Company,	"
Cambridge Gas-Light Company,	"
Brookline Gas-Light Company,	"
Jamaica Plain Gas-Light Company,	"
Newton & Watertown Gas-Light Co.,	"
Waltham Gas-Light Company,	"
Chelsea Gas-Light Company,	"
Fitchburg Gas-Light Company,	"
Marlboro' Gas-Light Company,	"
Clinton Gas-Light Company,	"
Milford Gas-Light Company,	"
Attleboro' Gas-Light Company,	"
Lawrence Gas-Light Company,	"
Lowell Gas-Light Company,	"
Lynn Gas-Light Company,	"
Springfield Gas-Light Company,	"
Worcester Gas-Light Company,	Mass.
Taunton Gas-Light Company,	"
New Bedford Gas-Light Company,	"
North Bridgewater Gas-Light Company,	"
Plymouth Gas-Light Company,	"
Middleboro' Gas-Light Company,	"
Marblehead Gas-Light Company,	"
Leominster Gas-Light Company,	"
Malden & Melrose Gas-Light Company,	"
Quincy Gas-Light Company,	"
Woburn Gas-Light Company,	"
Providence Gas-Light Company,	R. I.
Pawtucket Gas-Light Company,	"
Newport Gas-Light Company,	"
New Haven Gas-Light Company,	Conn.
Portland Gas-Light Company,	Maine.
Lewiston Gas-Light Company,	"
Calais Gas-Light Company,	"
Rockland Gas-Light Company,	"
Manchester Gas-Light Company,	N. H.
Concord Gas-Light Company,	"
Nashua Gas-Light Company,	"
Exeter Gas-Light Company,	"
Dover Gas-Light Company,	"
Portsmouth Gas-Light Company,	"
Great Falls Gas-Light Company,	N. H.
St. Albans Gas-Light Company,	Vt.
Louisville Gas-Light Company,	Louisville, Ky.
Cincinnati Gas-Light Company,	Cincinnati, O.
People's Gas-Light Company,	Brooklyn, N.Y.
Citizen's Gas-Light Company,	" "
Williamsburg Gas-Light Co.	" "
Brooklyn Gas-Light Company,	"
Citizens' Gas-Light Company,	Newark, N.J.
Peoria Gas-Light Company,	Peoria, Ill.

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